SELECTED WATER RESOURCES ABSTRACTS

VOLUME 2, NUMBER 10
MAY 15, 1969

WR 69-03702 -- WR 69-04200

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SELECTED
WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
Office of Water Resources Research, U.S. Department of the Interior

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As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources. WRSIC is not presently prepared to furnish loan or retention copies of the publications announced.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas. Centers, and their subject coverage, now in operation are:

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions AND Suspensions

MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography; Johns Hopkins Univ., Baltimore, Md. Dept. of Geology; and Maryland Geological Survey, Baltimore.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03724

BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-03725

02. WATER CYCLE

2A. General

PROCEEDINGS: INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
National Science Foundation, Washington, D. C.
William E. Sopper, and Howard W. Lull.
Pergamon Press, Oxford, England. 813 pages. 1967. $45.

Descriptors: *Hydrologic aspects, *Watershed management, *Forest management, *Stream flow, Precipitation (Atmospheric), Interception, Snow management, Soil water, Ground water, Bogs, Evapotranspiration, Energy budget, Runoff, Water Yield Improvement, Erosion, Soil stability, Mathematical modeling, Water measurement, Revegetation.
Identifiers: *Forest hydrology, *Experimental watersheds, Watershed calibration, Rehabilitation (Watershed).

The beginning of the International Hydrological Decade on January 1, 1965 stimulated activity in hydrologic research and provided an appropriate occasion for the Symposium. It was sponsored by the School of Forest Resources of the Pennsylvania State University; the Northeastern Forest Experiment Station, Forest Service, USDA; the International Association of Scientific Hydrology; and Section II: Forest Influences and Watershed Management of the International Union of Forestry Research Organizations. More than eighty papers, forming a wealth of expert scientific knowledge, were presented under the following Session headings: Resumes of Forest Hydrology Research; Forests and Precipitation; Forests and Soil Water; Forests and Evapotranspiration; Forests and Runoff; Forests and Soil Stabilization; Research Techniques and Instrumentation; Panel Discussion of New Instruments. (Reigner-Forest Service)
W69-03806

THE RELATION BETWEEN RAINFALL AND RUNOFF,
Stanford Univ., Calif. Dept. of Civil Engineering.
Ray K. Linsley.
Journal of Hydrology, Amsterdam, Vol 5, No 4, pp 297-311, 1967. 15 p.

Descriptors: *Rainfall-runoff relationships, Rainfall simulators, *Runoff forecasting, Runoff coefficient, *Computers, Storm runoff, *Correlation analysis, Data collections, Model studies, Measurement, *Hydrologic data, Hydrographs, Flood forecasting, Depth-area curves, Infiltration, Precipitation (Atmospheric).
Identifiers: Empiricism.

Three hundred years of research in rainfall and runoff were reviewed. In the late 1660's Perrault's crude experimentation confirmed the casual relationship between rainfall and runoff. Following that time a lengthy period of empiricism caused by inadequate data existed until the correlation era when a descriptive picture of the runoff process and correlations between precipitation and runoff were developed. The computer era has demonstrated the possibility of simulating the runoff process on a computer. If proper kinds of hydrologic data are obtained a general simulation model which can reproduce the streamflow hydrograph on any stream gauged or ungauged with accuracy equaling the computer is a possibility. (Affleck-Arizona)
W69-03890

SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
California Univ., Davis. Dept. of Water Science and Engineering; and Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03936

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.
For abstract, see .
W69-03950

OPTIMAL IDENTIFICATION OF NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODELS BY QUASILINEARIZATION,
California Univ., Los Angeles.
John Woodson Labadie.
MS Thesis, Calif Univ Dep Eng, 1968. 72 p, 9 fig, 3 tab, 23 ref, 2 append. WRC No. WI34-4B-68, OWRR Project B-028-CAL.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, Approximation method, Digital computers, Computer programs, Model studies.
Identifiers: Quasilinearization, Prasad models.

Through quasilinearization, implicit solutions to a large class of nonlinear models can be obtained in terms of a maximizing operation on linear equations. This algorithm also provides for systematic determination of the optimal values of model parameters in the identification problem. Furthermore, a complete set of initial conditions need not be supplied. Application of quasilinearization to a recent nonlinear conceptual model of hydrologic system response confirms rapid convergence and accuracy of the algorithm, as long as initial approximations are adequate. If accurate modeling has been hampered by computational difficulties of the system identification problem, it is believed that knowledge of computational tools such as quasilinearization will do much to encourage more realistic modeling of hydrologic systems. A computer programming flow chart and a sample computation are included.
W69-03958

TREE-RING ANALYSIS: A TOOL FOR WATER RESOURCES RESEARCH,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
Harold C. Fritts.
EOS, Trans Amer Geophys Union, Vol 50, No 1, pp 22-29, Jan 1969. 8 p, 3 fig, 18 ref.

Descriptors: *Dendrochronology, *Climatology, Trees, Paleoclimatology, Weather, Hydrology.
Identifiers: Dendroclimatology.

The uses of tree-ring analysis in hydrological studies are reviewed and new applications are suggested. A conceptual model relating tree ring width to climatic factors is proposed. It is hypothesized that climate of the period preceding ring formation is important because growth is controlled by stored rather than currently available food and soil moisture. A tree-ring analysis for climatic history of a site starts with selection of trees in the most climatically sensitive part of the site, usually a dry area near a forest fringe. Then trees are cored until the best samples are found, selected for good correlation, and the rings are first used to date the cores. Ring widths are then entered into computer programs for statistical analysis. Several types of data treatment are suggested. By computing a lag time, ring widths may be correlated with dry or wetperiods. A bibliography is included. (Knapp-USGS)
W69-03963

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-04015

RESPONSE OF SPRINGFLOW TO SOME CLIMATIC VARIABLES IN SOUTHWESTERN WISCONSIN,
Forest Service (USDA) St. Paul, Minn. North Central Forest Experiment Station.
Willie R. Curtis.
Water Resources Res. 1966, 2 (2): 311-314, illus.

Descriptors: *Springs, *Distribution patterns, *Precipitation (Atmospheric), *Hydrologic cycle, *Groundwater, Aquifers, Fluctuation, Groundwater recharge, Soil water, Frozen ground, Infiltration, Barometric efficiency.

Field investigations show the relationships of springflow to some climatic variables in southwestern Wisconsin. These observations indicate that springflow fluctuates in much the same manner as recharge to groundwater. In addition, short-period fluctuations in springflow are caused by changes in barometric pressure. This influence is more pronounced during the dormant season. A good correlation was found between springflow and the base flow of a nearby stream.
W69-04016

ADSORPTION OF POLY (VINYL ALCOHOL) BY NATURAL SOIL AGGREGATES,
Adelaide Univ. (Australia). Waite Inst.
B. G. Williams, D. J. Greenland, and J. P. Quirk.
Australia J of Soil Research, No 4, pp 131-143, 1966. 6 fig, 2 tab, 20 ref.

Descriptors: *Adsorption, *Alcohols, *Soil aggregates, Pores, Molecular structure, Organic matter, Porous media, Soil properties, Sampling, Penetration, Cores.
Identifiers: *Polymers, *Polyvinyl alcohol, Soil cores.

A study was made on adsorption of poly (vinyl alcohol-PVA) by relatively undisturbed soil aggregates and soil cores. The principal factor controlling penetration of soil aggregates by PVA molecules was probably the size of soil pores in relation to size of the polymer molecules. Presence of naturally occurring organic matter could greatly reduce the extent of PVA adsorption by occupying adsorption sites and creating steric interference to polymer movement. Depth of penetration of PVA into a soil core from a free solution was aided by a water potential gradient. PVA represented a class of linear uncharged polymers and as such it was representative of the simplest type of synthetic organic polymers that could be effective in inducing soil aggregate stability to many soils in arid climates of the world. (Blecker-Ariz)
W69-04108

ELECTROKINETIC MEASUREMENTS OF COLLOIDAL-LADEN FLOW THROUGH A SAND COLUMN,
Purdue Univ., Lafayette, Ind.
E. J. Monke, and D. M. Edwards.
Indiana Acad. Sci. Proc., Vol 76, pp 377-385, 1966. 3 fig, 12 ref.

Descriptors: *Colloids, *Sands, *Zeta potential, *Porous media, *Flow measurement, Clays, Silica, Bacteria, Pores, Hydrogen ion concentration, Measurement, Soil physical properties, Columns, Seepage, Infiltration, Kinetics, Reservoir leakage.
Identifiers: Clogging.

This study investigated the effect of pH, period of operation and depth within a column on the electrokinetic properties of clay colloids and total colloidal clay-silica sand system. The pH control of the porous media system depended on whether the system was used to promote or inhibit rapid clogging of pores. The dominant reaction of the system was that of the silica sand column and accumulated bacteria on the clay colloids. Electrokinetic forces augmented by the charge orientation of bacteria could be the principal mechanism by which colloidal particles are retained in porous media. Information gained in the study could be used in arid lands with respect to sealing of reservoir bottoms or irrigation canals and stopping seepage of water through deep aquifers. (Blecker-Ariz)
W69-04112

STUDIES ON DEW FORMATION UNDER SEMI-ARID CONDITIONS,
Directorate of Agricultural Research, Potchefstroom (South Africa). Dept. of Agricultural Technical Services.
W. Baier.
Agricultural Meteorology, Vol 3, pp 103-112, February 1966. 3 fig, 2 tab, 19 ref.

Descriptors: *Dew, *Condensation, *Logging (Recording), Dew point, Semiarid climates, Soil surfaces, Rainfall disposition, Transpiration, Temperature, Soil moisture, Fluctuation, Water balance, Climatic data.
Identifiers: *Kessler dew recorder, *South Africa.

Reported here are results of dew recordings by means of the Kessler dew recorder above various soil surfaces under semi-arid climatic conditions in the interior of South Africa. Monthly amounts of dew varied from approximately 0.5 mm in late winter and spring to above 2 mm in autumn. The dew deposition on a lawn amounted to approximately 2% of the annual rainfall. Dew formation commenced on the average of 2-3 hours after sunset, but in extreme cases, particularly in winter, it commenced before sunset. Dewfall usually continued until sunrise or even one hour thereafter. Preceding rains seemed to be a condition for heavy dew formation. Dew formation was most frequent and intensive in autumn, when the soil was still adequately supplied with moisture and wide daily temperature fluctuations occurred. Dew may benefit the internal water balance of plants grown in arid climates because transpiration is reduced during morning hours when dew is still present on the leaves. (Blecker-Ariz)
W69-04115

GEOPHYSICAL, ISOTOPE AND TRACER TECHNIQUES IN WATERSHED RESEARCH,
California Univ., Davis. Dept. of Water Science and Engineering.
David C. Lewis.
Transactions of the ASAE, Vol 11, No 5, pp 601-607, Sept-Oct 1968. 1 fig, 1 tab.

Descriptors: *Watersheds (Basins), *Tracking techniques, *Tracers, *Radioisotopes, *Geophysics, Runoff, Measurement, Precipitation (Atmospheric), Water storage, Rainfall-runoff relationships.

A review was given of each process that occurs in the runoff cycle with a discussion of the applicable geophysical, isotope, and tracer techniques, their limitations, and current or potential uses in watershed research. Those processes included were precipitation, interception, and depression storage, infiltration and soil moisture, interflow, percolation, groundwater storage and movement, evaporation, transpiration, snowmelt, erosion, sediment transport, baseflow, surface runoff, overland flow, and channel flow. In reviewing the watershed system process by process, it was found that geophysical, isotope and tracer techniques were very important in the measurement of process variables and media characteristics. Definitions of the various geophysical, isotope and tracer techniques discussed in the paper were given. (Affleck-Ariz)
W69-04119

HYDROLOGICAL STUDIES IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
George R. Higgins.
Publication No 6, termination report, Water Resources Research Center, June 30, 1968. 36 p, 17 ref, 1 append. OWRR Project A-003-Mass.

Descriptors: *Storage-yield relations, *Evaporation, Hydrologic response, Stream flow synthesis, Mathematical modelling.

The progress to date for Project WR - 3 is described in this report. Results of yield studies on Massachusetts streams, initiation of evaporation studies on Quabbin Reservoir and applications of hydrologic techniques to existing data are presented along with recommendations for future studies. Computer applications to the Rippl diagram for storage-yield relations have been conducted and include manipulations of the periods of analysis, variations in the time of beginning of the water year, and storage-yield plots that emphasize the impact of the 1961-67 drought. An evaporation station has been established on Quabbin Reservoir and useful data concerning radiation, relative humidity, and winds speeds for applications in the mass transfer and energy budget methods have been collected since June 1967. Hydrologic response functions and applications of statistical methods to hydrologic data are currently being studied for analysis and refinement of design methodology in water resource planning. It is anticipated that data collected on project WR - 3 will be applicable to a full assessment of the drought, for mathematical modelling techniques to thermal stratification, and other related projects.
W69-04131

2B. Precipitation

SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
Hawaii Univ., Honolulu. Dept. of Chemistry; and Hawaii Institute of Geophysics, Honolulu.
Yuk-Bon Seto, Robert A. Duce, and Alfred H. Woodcock.
Office Naval Res 3748 (04). Work supported in major part by Office of Naval Research. J Geophys Res, Vol 74, No 4, pp 1101-1103, Feb 1969. 3 p, 1 fig, 8 ref.

Descriptors: *Chemistry of precipitation, *Precipitation (Atmospheric), Sodium compounds, Salts, Chlorides, Rainfall, Hawaii, Altitude.
Identifiers: Bromine, Iodine, Particles, Chloride ratios, Altitude-chloride ratio relations.

Sodium and chloride analyses were performed on approximately 400 rain samples collected on the windward slopes of the island of Hawaii at altitudes from 535 to 1560 m above sea level. These altitudes correspond to distances of approximately 11 to 27 km from the eastern coastline of the island. Very little variation in the Na/Cl ratio with collection altitude was observed. It was previously shown that the I/Cl and Br/Cl ratios increase with increasing collection altitude in Hawaiian rains. The present results indicate that the I/Cl and Br/Cl increases are not due to loss of chlorine from the rain or the particles incorporated into the rain but must be due to addition of iodine and bromine.
W69-03735

FOG,
Joel N. Myers.
Sci Amer, Vol 219, No 6, pp 75-82, Dec 1968. 9 p, 15 fig.

Descriptors: *Fog, *Fog dispersion, Air pollution, *Smog, Smoke, *Air pollution effects, *Meteorology, *Cloud seeding, Cloud physics, Hazards, Drops (Fluids), Atmospheric pollution, Artificial precipitation, Haze, *Weather modification, Air pollution, Clouds, Atmospherics, Mist.
Identifiers: Air pollution control, Atmospheric research.

Fog is simply a cloud on the ground, composed of tiny water droplets, or more rarely, ice crystals. Fog is a growing problem to man, presenting hazards to travel, increasing air pollution, and in combination with air pollution, may modify the climate and upset the delicate balance of man's ecosystem. The incidence, duration, and probably the intensity of fogs vary directly with the amount of air pollution and industrial activity in the area involved. The smogs of urban areas and the lethal fogs in London and Pennsylvania are described. The formation and meteorological classification of fog, and effects on air pollution are discussed. Methods for dissipating fogs are reviewed; no universally practicable method has been found. The most promising method appears to be seeding the fog with a catalyst or agent, causing the droplets to grow large enough to fall. Artificial fog dissipation is costly and much might be done to prevent the formation of fog. Developing fog prevention and dispersal methods may lead to eventual solution of the fog problem, but success will depend on achieving an effective control over pollution of air and water. (USBR)
W69-03786

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 03B.
For abstract, see .
W69-03950

RAINFALL DISTRIBUTION OVER DISSECTED TERRAIN IN SOUTHWESTERN WISCONSIN,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard S. Sartz.
Water Resources Res. 1966, 2 (4): 803-809, illus.

Descriptors: *Precipitation (Atmospheric), *Micrometeorology, *Storms, *Topography, *Wind velocity, Distribution patterns, Climatic data, Valleys, Slopes, Small watersheds, Weather patterns.

Rainfall studies on the Coulee Experimental Forest in southwestern Wisconsin have shown that the dissected terrain of the area has only a small effect on annual point rainfall. On a steep ridge, rain gages on the windward side caught 3% less rain than gages on the leeward side. The difference for the storms of 0.5-inch precipitation or more was only 2%. A comparison of rainfall caught by ridge and valley gages indicated that ridge gages tended to catch more, but these differences were also small. Thus, rainfall on the experimental forest varies from place to place, but the differences probably result more from normal storm variation than from topographic effects per se.
W69-04014

SEASONAL PRECIPITATION AND SCALED QUAIL IN EASTERN NEW MEXICO,
New Mexico Dept. of Game and Fish, Albuquerque.
Howard Campbell.
Jour of Wildlife Mgt, Vol 32, No 3, pp 641-644, July 1968. 2 tab.

Descriptors: *Precipitation (Atmospheric), *Seasonal, *New Mexico, *Game birds, *Density, Rainfall disposition, Animal populations, Hunting, Correlation analysis, Data collections, Dry seasons, Wet seasons.
Identifiers: *Scaled quail, *Quail, Correlation coefficient.

The purpose of this paper was to document a positive relationship between spring-summer rainfall in eastern New Mexico and scaled quail population density as indicated by hunting success during 1957-66. It was assumed that for any large area, hunter success bore a direct but not necessarily proportional, relationship to quail density. Using this assumption it appeared that the quail population of eastern New Mexico was significantly influenced and perhaps controlled by spring-summer rainfall. The correlation between fall-winter precipitation and hunter success was not statistically significant. Therefore, it seems that unlike the situation in Arizona with respect to Gambel's quail, fall-winter precipitation had no important influence on the scaled quail population studied. (Affleck-Ariz)
W69-04120

RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
Robert A. Clark.
Technical Report No. 15, Feb 1969. 96 p, 16 tab, 19 fig, 48 ref, 1 append. OWRR Project A-002-Tex.

Descriptors: *River forecasting, *Rainfall-runoff relationships, Radar meteorology, Hydrograph analysis, Forecasting, *Stochastic processes, Monte Carlo method, *Hurricanes.

This project has consisted of two distinct phases: (1) equipment modification and installation with associated collection and (2) analyses of data plus development of hydrologic techniques. Errors inherent in the utilization of radar as a hydrologic sensor are discussed. It is shown that errors in the measurement of in-cloud liquid water content can be as much as 100 per cent. Similar results will be obtained in the measurement of rainfall rates by weather radar. It is demonstrated that radar can be used quite effectively in the synthesis of hydrographs. In particular, the feasibility of using radar in streamflow forecasting has been tested for the Little Washita River in Oklahoma. The results were very encouraging. Techniques for hydrograph synthesis are discussed. These have been combined with a stochastic model (which incorporates a sixth-order Markov chain) for rainfall-runoff simulation. The proposed model has been tested thoroughly and appears to hold promise as a forecasting tool. A study was made of Hurrican Beulah which produced extremely heavy precipitation in south Texas and fostered an unprecedented number of tornadoes. The injection of dry air into the area northeast of the parent cyclone was apparently responsible for the extreme instability and development of a large number of tornadoes in that region.
W69-04135

2C. Snow, Ice, AND Frost

GLACIER OUTBURST FLOODS IN THE PACIFIC NORTHWEST,
Geological Survey, Tacoma, Wash.
Donald Richardson.
Geol Surv Res 1968, Prof Pap 600-D, pp D79-D86, 1968. 8 p, 3 fig, 6 ref.

Descriptors: *Floods, *Glaciers, *Melt water, Mudflows, Disasters, Debris avalanches, Landslides.
Identifiers: Glacier outburst floods.

Glacier outburst floods, not uncommon in the Pacific Northwest in late summer or fall, are sometimes triggered by heavy rain but may occur even during a rainless period. Associated mudflows often compound the destruction downstream. Outburst floods are particularly hazardous at Mount Rainier, Washington, where debris flows are reported to occur at a rate of 1 in 3-10 yr. Several floods witnessed at Mount Rainier were much larger, than expected from direct storm runoff or release of water temporarily impounded by landslides. The principal source of those floods is believed to have been the large volumes of water that are stored at times within and beneath glacier. At present there is no known way of predicting glacier outburst floods. Conceivably, their imminence might be indicated by measurements of englacial water pressure, and their potential size would be indicated by determinations of the volume of water stored in glaciers. (Knapp-USGS)
W69-03741

RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
Forest Service (USDA) Wenatchee, Wash. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03807

2D. Evaporation and Transpiration

EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
Geological Survey, Baton Rouge, La.
Fred N. Lee.
La Dep Public Works Tech Rep No 4, 1969. 13 p, 4 fig, 3 tab, 4 ref.

Descriptors: *Evaporation, *Evapotranspiration, *Mass transfer, Water balance, Seepage, Regression analysis, Louisiana.
Identifiers: Mass transfer coefficient.

The mass-transfer coefficient, n, for the evaporation equation used by the U. S. Geological Survey was determined by regression analysis of data from a 2 1/2 acre pond near Baton Rouge, Louisiana. The value of $N = 0.00041$, obtained from analysis of data from 5 years of study, 1962-7, compares well with values from 2 other humid sites in Florida and North Carolina, but is slightly greater than would be expected in similar size ponds in a more arid climate. Seasonal variation of the combined effects of inseepage, outseepage, and evapotranspiration was determined to be as much as +0.003 ft per day in summer and -0.005 ft per day in winter, applied to a base loss of 0.0048 ft per day. (Knapp-USGS)
W69-03731

MEASUREMENT OF NATURAL EVAPORATION: COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
British Meteorological Office, Cambridge (England). Research Unit.
M. J. Blackwell, and J. B. Tyldesley.
UNESCO, Arid Zone Research, Vol 25, pp 141-148, 1968. 8 p, 3 fig.

Descriptors: *Evaporation, Energy budget, Meteorological data, Heat transfer, Lysimeters, Arid lands, Fluctuation, Instrumentation, Water loss, *Measurement, *Gravimetry, Data processing, Water vapor, Temperature, Equations, Stability, Latent heat.
Identifiers: *Aerodynamics, Sensible heat.

Aerodynamic and energy balance methods of measuring natural evaporation from land surfaces were compared. The modern weighing lysimeter was used in the experiment to determine relative merits of the two methods for evaluating water losses. Suggestions were made for extending their use in arid regions. The aerodynamic method can be modified for more general application by including an empirical correction for stability, and this was recommended particularly for arid zone studies. The energy balance approach could also be modified by allowing for variation of eddy diffusivities for heat and water vapor at large negative Richardson numbers. Both methods were exacting in instrumental techniques, and it may be necessary to combine some aspects of both when horizontal gradients of temperature and humidity are no longer small. This is likely to be the case in normally arid areas, near the boundary of irrigated crops. when the influence of small scale advection is like_y to be significant. (Affleck-Arizona)
W69-03891

ANOTHER EVAPORATION FORMULA,
Texas A and M Univ., College Station. Dept. of Meteorology.
J. F. Griffiths.
Agricultural Meteorology, Vol 3, No 3, 4, pp 257-261, 1966. 2 fig, 1 tab.

Descriptors: *Evaporation, *Evaporation pans, *Equations, Climatology, Meteorology, Southwest U.S., Texas, Temperature, Air circulation, Data collections, Regression analysis.
Identifiers: *Formulae, Parameters, Evaporation equation.

The object of the investigation was to derive some simple equation for evaporation using standard meteorological parameters that could be applied in areas of the southwestern United States and would have an accuracy within the requirements of practical demands. The study considered the logic of the evaporation equation and stressed need for a realization of the accuracy required and the practical aspects of the problem. Mean monthly pan evaporation figures for a number of stations in Texas disclosed an apparently close relationship between evaporation, mean temperature and air flow. The study showed that over certain large areas of the Southwest, a very simple evaporation equation is of adequate accuracy for practical purposes. (Blecker-Ariz)
W69-04107

A SYSTEM FOR SHORT INTERVAL MEASUREMENT OF EVAPOTRANSPIRATION,
New York State Agricultural Experiment Station, Geneva.
N. H. Peck, L. N. Mielke, and M. T. Vittum.
Agronomy J., Vol 59, No 6, pp 607-609, Nov-Dec 1967. 4 fig.

Descriptors: *Evapotranspiration, *Beans, *Measurement, *Sands, *Nutrients, Instrumentation, Logging (Recording), Cycling nutrients.
Identifiers: Snap beans, Peak rates, Culture beads, Sand-nutrient culture.

A sand-nutrient culture system was designed to measure evapotranspiration of snap beans under field conditions. One advantage of the system was that evapotranspiration could be measured for periods as short as 2 hours, thus permitting an accurate determination of peak rates and correlation of these peak rates with simultaneous weather. The system could be used in arid climates to measure the effect of transpiration suppression agents on vegetated areas. (Blecker-Ariz)
W69-04110

STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
West Pakistan Agricultural Univ., Lyallpur. Dept. of Plant Breeding and Genetics.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-04117

ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
Western Australia Univ., Nedlands. Dept. of Botany.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-04118

HYDROLOGICAL STUDIES IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-04131

2E. Streamflow and Runoff

VELOCITY-DISTRIBUTIONS IN STRAIGHT RECTANGULAR CHANNELS,
Hydronautics, Inc., Laurel, Md.
Chin-lien Yen.
Tech Completion Rep 801-3, No 3 of 3 vol, July 1968. 17 p, 8 fig, 9 ref. OWRR 14-01-0001-1572. C-1008.

Descriptors: *Dispersion, *Open channel flow, Dimensional analysis, Turbulent flow, Laminar flow, Diffusion, Mixing, Path of pollutants, Streamflow, Viscosity, Reynolds number, Convection, Roughness (Hydraulic).
Identifiers: Longitudinal dispersion, Straight channels.

Experimental data for velocity-distributions in turbulent flow in straight rectangular channels with varying width-depth ratios and boundary roughnesses were collected from various sources and analyzed in an attempt to produce a generalized velocity-distribution for this type of channel flow. From the available data for smooth channels, it is clearly seen that when the width-depth ratio exceeds a value of about 5 a central portion of the channel, called the wall-free zone, has a velocity-distribution of 2-dimensional nature. Based on this fact, dimensional analysis is applied in search for the possible parameters to generalize the velocity-distributions in the outer-law region where viscosity plays no role in determining the flow pattern. Analysis of the available data shows that velocity-distributions correlate reasonably well for different width-depth ratios in the regions not too close to the boundaries. A dimensional analysis is also carried out for the inner-law region. It is pointed out that a unique inner-law relationship will definitely lead to the consequence that the viscous sublayer becomes thicker around the corners of a rectangular channel. Based on measured boundary shear stress, 2 examples are calculated to demonstrate the actual thickening. Some velocity-distribution data for rough rectangular channels are also presented to show a general trend of variations, but no effort was made to generalize these data because not enough data could be collected.
W69-03703

A DISCUSSION OF THE DISPERSIVITY TENSOR FOR A TURBULENT UNIFORM CHANNEL FLOW,
Hydronautics, Inc., Laurel, Md.
G. Dagan.
Tech Completion Rep 801-2, No 2 of 3 vol, June 1968. 28 p, 3 fig, 20 ref. OWRR 14-01-0001-1572. C-1008.

Descriptors: *Dispersion, *Open channel flow, Turbulent flow, Laminar flow, Diffusion, Mixing, Path of pollutants, Streamflow, Viscosity, Reynolds number, Convection.
Identifiers: *Dispersivity tensors, Mixing length, Eddy viscosity.

The turbulent mixing of a pollutant in a stream flow is described with the aid of the dispersivity tensor. In a 2-dimensional (pipe or wide channel) flow only the radial (or vertical) dispersivity coefficient is significant and is usually determined through the Reynolds analogy. The analogy is extended to a 3-dimensional (i.e. channel of arbitrary section) uniform flow. It is shown that the mixing length theory leads to the representation of the dispersivity tensor in the terms of only 2 distinct coefficients: + REPRESENTING MIXING NORMAL TO ISOVELS WHICH MAY BE FOUND THROUGH Reynolds analogy and a lateral dispersivity coefficient which has to be determined from dispersivity measurements.
W69-03704

CALCULATION OF THE DISPERSION COEFFICIENT IN STRAIGHT PRISMATIC STREAMS,
Hydronautics, Inc., Laurel, Md.
C. L. Yen, and C. Elata.
Tech Completion Rep 801-1, No 1 of 3 vol, June 1968. 25 p, 5 fig, 10 ref. OWRR 14-01-0001-1572. C-1008.

Descriptors: *Dispersion, *Open channel flow, Turbulent flow, Laminar flow, Diffusion, Mixing, Path of pollutants, Streamflow, Viscosity, Reynolds number.
Identifiers: Longitudinal dispersion, Straight channels.

A general approximate expression for the dispersion coefficient of flow in a straight prismatic conduit is developed. Dispersion coefficients are calculated for flow in a straight pipe as a function of velocity distribution and friction coefficient--neglecting the laminar sublayer. The results show that the effect of friction coefficient on the dimensionless dispersion coefficient is very slight. Calculations are also carried out for turbulent flow in a straight smooth pipe with a logarithmic velocity distribution outside and a linear distribtuion within the laminar sublayer. The effect of the laminar sublayer on the dispersion coefficient appears to be very large, with the dispersion coefficient increasing rapidly when the relative thickness of the laminar sublayer increases, i.e., when Reynolds number decreases. Actual measurements of the dispersion coefficient are usually made when the average concentration of the dispersing pollutant outside the laminar sublayer reaches a Gaussian distribution in the longitudinal direction, but the occurrence of a Gaussian distribution for the entire pollutant requires a much longer distance downstream. Calculations for the first case show remarkably good agreement with measurements assembled from several sources. To determine the effect of the geometrical configuration of conduits, dispersion coefficients are calculated in elliptical open channels with various assumed velocity distributions and width to depth ratios. It is shown that the dispersion coefficient depends heavily on velocity distribution, increasing with the average velocity defect.
W69-03705

EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
Geological Survey, Richmond, Va.
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-03706

FLOODS IN BEECHER WEST QUADRANGLE, NORTHEASTERN ILLINOIS,
Geological Survey, Washington, D. C.
Howard E. Allen.
U S Geol Surv Hydrol Invest Atlas HA-257, 1 sheet, 1968. Text, 10 fig, 2 ref.

Descriptors: *Floods, Hydrologic data, *Flood forecasting, Frequency analysis, Discharge measurements, River flow, Streamflow forecasting, Gages, Flood plains.
Identifiers: *Northeastern Illinois, Flood profiles, Hydrologic characteristics.

Hydrologic data are presented that can be used to forecast and evaluate floods and water supply possibilities of the Beecher West Quadrangle, Illinois. On the basis of observations collected by several hydrologic stations for several years, the frequencies of flood discharges and flood stages were evaluated. The drainage areas and flood profiles of several creeks in the area were evaluated and given in conjunction with a topographic map of 1:24000 scale. The author briefly discusses the following hydrological properties of the several flood plains: flood heights; flood discharge; flood frequency; recurrence intervals; flood profiles; and additional data sources. (Gabriel-USGS)
W69-03720

STAGE MEASUREMENT AT GAGING STATIONS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03721

WATER AVAILABILITY OF GENEVA COUNTY, ALABAMA,
Geological Survey, University, Ala.
J. C. Scott, H. G. Golden, and J. R. Avrett.
Ala Geol Surv Water Availability Map No 55, 1968. 1 sheet, text, 3 fig, 4 tab.

Descriptors: *Water resources, Groundwater, Surface waters, Water quality, Water yield, Alabama, Aquifers, Streamflow.
Identifiers: Geneva County (Alabama).

The water resources of Geneva County, Alabama are discussed in a 1-sheet water availability map and text. The 2 major aquifers in the county are artesian. The shallow aquifer, consisting of sand and limestone, yields 0.3 to 1.0 mgd per well. The deep aquifer, of gravel, sand, and limestone, yields 1.5 to 3.0 mgd per well. The water is suitable for most purposes but may in some areas be too hard or contain too much Fe and Cl for some uses. Average annual runoff is about 22 inches or 1.04 mgd per sq mi. Average streamflow is about 3,000 mgd. Surface water is soft and slightly acid. Water availability in streams and wells, depth to water, hardness of groundwater, low flow, and surface water quality are shown on maps and cross sections. Geologic units and their water-bearing characteristics are shown on a stratigraphic chart. Records of wells and springs and chemical analyses are tabulated. (Knapp-USGS)
W69-03733

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
Geological Survey, University, Ala.
P. C. Reed, J. C. Scott, H. G. Golden, and J. R. Avrett.
Ala Geol Surv Water Availability Map No 57, 1968. 1 sheet, text, 7 fig, 1 map, 5 tab, 1 ref.

Descriptors: *Water resources, Groundwater, Surface waters, Water quality, Water yield, Alabama, Aquifers, Streamflow.
Identifiers: Butler County (Alabama).

The water resources of Butler County, Alabama, are discussed in a 1-sheet water availability map and text. The principal aquifers in the county are sand beds in Gulf Coastal Plain Tertiary and Cretaceous sediments. The groundwater in the county is satisfactory for most uses, but some wells yield water too hard or too high in Fe for some industrial uses. The average annual runoff is about 19 inches or 0.9 mgd per sq mi. Surfaces waters of the county are generally soft and slightly acid. Water availability in streams and wells, depth to water, hardness of groundwater, low flow, iron content of groundwater, and surface water quality are shown on maps and cross sections. Geologic units and

their water-bearing characteristics are shown on a stratigraphic chart. Records of wells and springs and chemical analyses are tabulated. (Knapp-USGS)
W69-03734

A WATER-BALANCE EQUATION FOR THE RATHDRUM PRAIRIE GROUND-WATER RESERVOIR, NEAR SPOKANE, WASHINGTON,
Geological Survey, Washington, D. C.; and Geological Survey, Boise, Idaho.
E. J. Pluhowski, and C. A. Thomas.
Geol Surv Res 1968, Prof Pap 600-D, pp D75-D78, 1968. 4 p, 2 fig, 1 tab, 2 ref.

Descriptors: *Water balance, *Aquifers, *Glacial drift, *Underflow, washington, Groundwater movement, Recharge, Discharge (Water), Water yield.
Identifiers: Rathdrum Prairie aquifer (Wash), Spokane.

The highly permeable sand and gravel deposits which form the Rathdrum Prairie aquifer effectively store and transmit large quantities of groundwater. From a water-balance equation for the groundwater reservoir, it is estimated that underflow from the aquifer to the Spokane Valley averages about 1,000 cubic ft per second, or about 650 mgd. This water enters the Spokane River in the reach between Otis Orchards and Long Lake, Wash. (Knapp-USGS)
W69-03740

GLACIER OUTBURST FLOODS IN THE PACIFIC NORTHWEST,
Geological Survey, Tacoma, Wash.
For primary bibliographic entry see Field 02C.
For abstract, see .
W69-03741

GENERAL FIELD AND OFFICE PROCEDURES FOR INDIRECT DISCHARGE MEASUREMENTS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03748

MEASUREMENT OF PEAK DISCHARGE AT WIDTH CONTRACTIONS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03753

ESTIMATING DESIGN FLOODS FROM EXTREME RAINFALL,
Colorado State Univ., Fort Collins; and New South Wales Univ., Kensington (Australia).
Frederick C. Bell.
Colorado State Univ, Hydrol Pap, No 29, Ft Collins, July 1968. 21 p, 20 fig, 5 tab, 39 ref.

Descriptors: *Design flood, *Rainfall, *Precipitation (Atmospheric), Watersheds (Basins), Drainage basins, *Forecasting, Bibliographies, Hydrology, Floods, Small watersheds, Hydrologic data, Time, Time lag, Flood forecasting, Flood hydrographs, Flood peaks, Design storm, Rainfall-runoff relationships, Rational formula, *Storm runoff.
Identifiers: Flood hydrology.

Distinct differences exist between estimating specific floods from data on specific rainfall events and estimating design or representative floods from rainfall statistics. The latter should be regarded as a more generalized procedure in which high accuracy cannot be expected. Many physical details of specific events are irrelevant for estimating representative events. A single parameter is sufficient to express the time-distributing characteristics of a watershed for design purposes. The suggested parameter is the representative lag, closely related to the volume/peak ratio. For small watersheds in the western U. S., the same return period may be assigned to the design flood and the corresponding extreme rainfall. This finding is not expected to apply to all climatic situations, but may be a reasonable assumption in the absence of any other information. The rational-loss rate method is suggested for estimating extreme floods from extreme rainfall because of its simplicity, flexibility, and consistency with the requirements and limitations of the problem. This method does not give satisfactory reproductions of the 10-yr floods on the test watersheds and cannot be strongly supported by this performance. (USBR)
W69-03783

FLOOD PLAIN INFORMATION OF LEFT-HAND CREEK, VOLUME 1, BOULDER COUNTY, COLORADO.
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03926

FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF BARSTOW), SAN BERNARDINO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03927

FLOOD PLAIN INFORMATION, AUGLAIZE RIVER, WAPAKONETA, OHIO.
Corps of Engineers, Detroit, Mich.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03928

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER, LITTLE VALLEY AND GREAT VALLEY CREEKS, SALAMANCA, NEW YORK.
Corps of Engineers, Pittsburgh, Pa.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03929

FLOOD PLAIN INFORMATION, OUACHITA RIVER, WEST MONROE, LOUISIANA.
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03930

FLOOD PLAIN INFORMATION, CONCORD AND SHAWSHEEN RIVERS, BEDFORD, MASSACHUSETTS.
Corps of Engineers, Waltham, Mass.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03931

FLOOD PLAIN INFORMATION-SOUTH FORK EEL RIVER, WEOTT TO MYERS FLAT, HUMBOLDT COUNTY, CALIFORNIA.
Corps of Engineers, San Francisco, Calif.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03932

FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
Chesapeake Bay-Susquehanna Rivers Basins Project, Susquehanna Field Station.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03934

SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
California Univ., Davis. Dept. of Water Science and Engineering; and Washington State Univ., Pullman. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03936

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
Geological Survey, Washington, D. C.
Perry G. Olcott.
Geol Surv Hydrol Invest Atlas HA-321, 4 sheet, 1968. 13 map, 4 tab, 21 ref, text.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Wisconsin, Water wells, Hydrologic data, Aquifers, Water quality, Streamflow, Hydrographs, Flow characteristics, Water utilization.
Identifiers: Fox River (Wis), Wolf River (Wis).

The water resources of the Fox-Wolf River basin, Wisconsin are described in a 4-sheet reconnaissance hydrological atlas. A generalized hydrologic budget of the basin is shown graphically. Groundwater availability, movement, and quality are shown on maps. Surface water discharge, high-flow recurrence, low-flow recurrence, and quality-discharge relations are shown graphically and by maps. Chemical analyses are tabulated. In general, both ground- and surface water are more available and at higher quality in outwash areas and less in lake-bed and ground moraine areas. Industry and commerce use about 65% of the water withdrawn in the area, municipalities about 20%, and stock rural domestic, and irrigation about 15%. Use is summarized by a map and a table. Recreational use is also summarized by a map and a table. Pollution is a problem in the lower Fox River. Saline water intrusion from aquifers in the SE part of the basin is possible if local areas are over pumped. Groundwater is generally hard. Geology, lithology of aquifers, water-bearing properties of aquifers, streamflow characteristics, and quality of ground- and surface water are summarized in a table. (Knapp-USGS)
W69-03939

ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
Bureau of Reclamation, Washington, D. C.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03940

INDEX OF SURFACE-WATER RECORDS TO SEPTEMBER 30, 1967. PART 8- WESTERN GULF OF MEXICO BASINS,
Geological Survey, Washington, D. C.
H. P. Eisenhuth.
Geol Surv Circ No 578, 1968. 51 p, 1 fig.

Descriptors: *Data collections, Gaging stations, Flow measurement, Stream gages, Gulf Coastal Plain, Discharge measurement, Streamflow.
Identifiers: Index of gaging stations, Western Gulf of Mexico basin.

The streamflow and reservoir stations in th Western Gulf of Mexico basins for which records have been or are to be published in reports of the Geological Survey are listed for periods through September 30, 1967. In addition to the continuous-record gaging stations, crest-stage and low-flow partial-record stations are included. A continuous-record station is a gaging station on a stream of reservoir for which the discharge, stage, or contents is published on a daily, weekly or monthly basis for a continuous period of time. A crest-stage partial-record station is a streamflow station for which only the annual maximum discharge is published over a period of years for use in flood-flow analyses. A low-flow partial-record station is a streamflow station for which only discharge measurements made at base flow, when streamflow is

primarily from ground-water storage, are published. Measurements are generally collected over a period of 5 yr or more for use in low-flow analyses. Discharge measurements have been made at many sites and published as miscellaneous measurements. Such measurements are not included except those made in earlier years at sites now classified as low-flow partial-record stations. (Knapp-USGS)
W69-03942

FLUOROMETRIC PROCEDURES FOR DYE TRACING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03944

MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
Harry Hulsing.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A5, 1968. 29 p, 25 fig, 4 tab, 12 ref.

Descriptors: *Stream gages, *Discharge measurement, *Weirs, *Stage-discharge relations, Control, Spillway crests, Dams, Embankments, Submergence.
Identifiers: Technical manuals, Stream gaging, Submergence effects, Sharp-crested weirs, Broad-crested weirs, Round-crested weirs.

Procedures used by the U. S. Geological Survey for measuring peak stream discharges using dams, weirs, and embankments are described. Field and office procedures limited to this method are discussed. Discharge coefficients and formulas are given for 3 general classes of weirs - sharp-crested, broad-crested, and round-crested - and for highway embankments and weirs of unusual shape. The effects of submergence are defined for most forms. (USGS)
W69-03945

HYDROLOGIC DATA: 1967 - VOLUME 1: NORTH COASTAL AREA.
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03951

MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, Washington, D. C.
P. E. LaMoreaux, R. M. Alverson, J. G. Newton, W. E. Smith, and W. J. Powell.
Geol Surv of Ala Inform. Ser 37, 1968. 41 p, 11 fig, 5 tab, 17 ref.

Descriptors: *Water resources, Groundwater, Surface waters, Water quality, Alabama, Streamflow, Runoff, Water wells, Aquifers.
Identifiers: Barbour County (Ala), Water availability.

The water resources of Barbour County, Alabama, are surveyed as part of a report of the county's total resources. Annual precipitation in the county averages over 40 inches. Groundwater availability is shown on maps and cross sections. Generally the south-dipping coastal plains sediments yield large amounts of water, which may in some wells be very hard or have a high iron content. Average annual surface runoff is about 18 in. or 0.85 mgd per sq mi. The average flow of the Chattahoochee River at Eufaula is about 6,600 mgd. Stream water is soft, low in chloride content, and slightly acid. It should be satisfactory for most industrial uses. Low flow, average flow, and chemical character are shown on maps. Geologic units and their water-bearing characteristics are shown in a stratigraphic chart. Records of wells and springs, chemical analyses, and streamflow data are tabulated. (Knapp-USGS)
W69-03952

RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03957

MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03967

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
Geological Survey, Washington, D. C.
S. K. Love.
Geol Surv Water-Supply Pap 1952, 1967. 148 p, 2 fig, 1 plate, 18 ref.

Descriptors: *Water quality, *Irrigation, *Surface waters, Drainage, Chemical analysis, Salinity, Sodium, Rivers, River basins, Hydrogeology.
Identifiers: *Hudson Bay, *Mississippi River basin, *Colorado River basin, Snake River basin, Missouri River basin, Yellowstone River basin.

This thirteenth annual compilation of data for 73 irrigation network stations on streams west of the Mississippi River contains records of chemical analyses, other physical measurements, and discharge. Together with Geological Survey Water-Supply Papers 1264 and 1361, for the years 1951 and 1952 respectively, it provides comprehensive information about the chemical quality of surface waters used for irrigation and the changes resulting from the drainage of irrigated lands. Tabular data are presented on periods of operation and water samples analyzed with particular reference to the use of water from these streams for irrigation. To complement the graphic data, the criteria of water quality used here is briefly outlined. The salinity and sodium classifications are also described. (Llaverias-USGS)
W69-03968

ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
Geological Survey, Washington, D. C.
Harry H. Barnes, Jr.
Geol Surv Water-Supply Pap 1849, 1967. 213 p, 100 photo, 50 tab, 50 sketch, 13 ref, index.

Descriptors: *Roughness (Hydraulic), *Roughness coefficient, *Photography, Remote sensing, Data collections, Channels, Open channel flow.
Identifiers: *Natural channels, *Photohydrology, Channel conditions.

Color photographs and descriptive data are presented for 50 stream channels for which roughness coefficients have been determined. Computations of open channel flow require an evaluation of channel roughness characteristics. This evaluation remains chiefly an art when a satisfactory quantitative procedure is lacking. Typical channels with known roughness coefficients are described, sketched, and shown in cross sections. The 100 photographs and data represent a wide range of channel conditions. Familiarity with the appearance, geometry, and roughness characteristics of these channels will improve the engineer's ability to select roughness coefficients for other channels. (Llaverias-USGS)
W69-03978

COMPILATION OF THE MAXIMUM STREAMFLOWS OF SNOWMELT WATERS IN USSR RIVERS (RUSSIAN),
A. A. Sokolov.
Leningrad, USSR, Gidrometeorologicheskoye Izdatel'stvo, 1967. 195 p.

Descriptors: *Hydrology, *Snowmelt, *River systems, *Hydrological characteristics, *Maximum probable flood, Parametric hydrology, River flow, River forecasting, Runoff coefficient, Mathematical models, Frequency analysis.
Identifiers: USSR Rivers.

Runoff of snowmelt waters was investigated by using data compilation from a network of hydrological stations that represent conditions for both mountain and plain types of river basins. Statistical and graphical methods were used to evaluate the volume of maximum runoff and various parameters and coefficients. The report is mostly a tabulation of information including drainage area, maximum and mean flow, and other hydrological parameters. It is based on the use of data recorded by 2370 hydrologic stations located in European Russia and Siberia. (Gabriel-USGS)
W69-03981

HYDROLOGIC CHARACTERISTICS OF SOIL TYPES,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
H. N. Holtan, Charles B. England, and D. E. Whelan.
J Amer Soc Civil Engin, Irrigation and Drainage Div, Vol 93, No IR3, pp 33-41, 1967. 9 p, 3 tab, 1 fig, 4 ref.

Descriptors: *Infiltration, Physical properties, Soil texture, *Soil types.
Identifiers: Northeast U S soils.

Physical properties of soil types are used to establish soil moisture volumes of gravitational and plant-available water above an impeding layer or horizon of the soil profile. Examples of soil moisture volumes are presented in tabular form for soil types representative of the Northeastern States. Volume of watershed retentions for specific conditions can be predicted by subtracting antecedent soil moisture from the total potential soil moisture storage above the impeding horizon and adding the volume of water percolating through the control horizon. (England-USDA Hydro Lab)
W69-04011

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-04013

ABUNDANCE AND CHARACTER OF MICROSESTON IN A CALIFORNIA MOUNTAIN STREAM,
Bureau of Sport Fisheries and Wildlife, Bishop, Calif.
J. A. Maciolek.
Verh Int Ver Limnol, Vol 16, pp 639-645, Dec 1966.

Descriptors: *California, *Streams, *Seston, Detritus, Diatoms, Grazing, Invertebrates, Lakes, Oligotrophy, Organic matter, Periphyton, Phytoplankton, Primary productivity, Secondary productivity, Streamflow, Trophic level, Trout.
Identifiers: *Microseston, Sierra Nevada (Calif), Convict Creek (Calif), Convict Lake (Calif), Mono County (Calif), Lake-stream systems, Trophodynamics, Simuliidae, Potamoplankton, Synedra, Asterionella, Fragillaria, Autochthonous sources, Allochthonous sources.

Secondary production in mountain streams largely depends upon microseston abundance. Author studied microsestonic changes over 13-month interval, beginning September 1962, in a Sierra Nevada, Calif, lake-stream system (Convict Creek drainage). Samples (125), collected at one principal and several reference stations several times per day at weekly intervals, were analyzed by wet dichromate oxidation for microseston (milli-

grams/liter). Microsestonic characteristics were quantified from area-weighted counts of microscopic preparations. Total microseston varied from 0.3 in autumn to 2.1 mg/liter just prior to peak streamflow (about 3-1/4 cubic meters/second) in late spring. Organic detritus dominated the microseston (annual mean - 60%), while miscellaneous microorganisms remained at 20% rather constantly, and lacustrine diatoms varied 0-50% (mean - 20%). Author estimates about 20% of microseston was autochthonous, 30-40% originated from lake, and 40-50% derived from streamside or more distant sources. Cyclic fluctuation in microseston during cold winter days correlated with diel flow patterns induced by ice formation. Filter-feeding invertebrates had rather constant food supplies, populations being partially limited by minimal 0.5 mg/liter and not exploiting excesses above 1 mg/liter because of high streamflow. Exploitation may also be limited by size and activity of populations. Food quality may govern production.
W69-04031

HYDROLOGICAL STUDIES IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-04131

RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-04135

2F. Groundwater

AVAILABILITY OF GROUND WATERS IN THE NORTHERN PART, TENMILE AND TAUNTON RIVER BASINS, SOUTHEASTERN MASSACHUSETTS,
Geological Survey, Washington, D. C.
John R. Williams.
Geol Surv Hydrol Invest Atlas HA-300, 1 sheet, 1968. 1 map, 1 tab, 6 ref, text.

Descriptors: *Aquifers, *Groundwater, *Hydrologic properties, *Aquifer characteristics, Water sources, Water supply, Water chemistry, Water table, Water properties, Water resources, Pumped storage, Swamps.
Identifiers: *Southeastern Massachusetts, Taunton Basin, Tenmile Basin.

Groundwater resources of the northern part of the Tenmile and Taunton River basins were investigated and plotted on a map of 1:24000 scale giving the availability of groundwater in the area by using various shades of blue color indicating a degree of availability of groundwater. The aquifers present in the area are subdivided into the principal and lesser ones. In their turn the principal and lesser aquifers are subdivided into sources of large, moderate, and favorable to the development of large or moderate supplies of water. The map contains a comprehensive description of geological properties of water-bearing formations and a brief chemical analysis of the aquifer waters. Estimated annual sustained yields and pumpage of principal aquifers are also given. (Gabriel-USGS)
W69-03723

WATER AVAILABILITY OF GENEVA COUNTY, ALABAMA,
Geological Survey, University, Ala.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03733

WATER AVAILABILITY OF BUTLER COUNTY, ALABAMA,
Geological Survey, University, Ala.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03734

THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03736

THERMAL AND SEISMIC INDICATIONS OF OLD FAITHFUL GEYSER'S INNER WORKINGS,
Environmental Science Services Administration, Boulder, Colo. Research Labs.
John S. Rinehart.
J Geophys Res, Vol 74, No 2, pp 566-573, Jan 1969. 8 p, 12 fig, 5 ref.

Descriptors: *Geysers, Thermal water, Seismic studies, Geothermal studies, Heat flow, Temperature, Groundwater movement, Boiling.
Identifiers: Old Faithful Geyser, Yellowstone National Park, Eruption mechanism, Thermal profile.

Recent temperature measurements within Old Faithful combined with earlier seismic data provide a fairly broad knowledge of the mechanics of the geyser's action. The geyser tube which is surprisingly deep, probably deeper than 175 m fills suddenly shortly after an eruption. Initially the water in the whole tube superheats, but the upper 60 m soon cools as the boiling works its way downward. Finally, the hotter water below the 60m level rises to the top fairly rapidly, again superheating the water in the upper regions, causing the eruption to start. The boiling rapidly cascades downward, thrusting water from the reservoir to continue the eruption.
W69-03737

GROUNDWATER DISCHARGE TOWARD GREAT SALT LAKE THROUGH VALLEY FILL IN THE JORDAN VALLEY, UTAH,
Geological Survey, Salt Lake City, Utah.
R. W. Mower.
Geol Surv Res 1968, Prof Pap 600-D, pp D71-D74, 1968. 4 p, 2 fig, 1 tab, 4 ref.

Descriptors: *Groundwater movement, *Discharge (Water), Aquifers, Artesian wells, Utah, Great Salt Lake, Seismic studies, Darcys law.
Identifiers: Jordan Valley (Utah), Valley fill aquifer.

Groundwater in the northern part of the Jordan Valley is principally under artesian conditions in valley fill of Quaternary age consisting of clay, silt, and sand. The water is moving generally toward the southeast shore of Great Salt Lake. The computed quantity of water discharging into Great Salt Lake from the valley fill in the northern part of the Jordan Valley is estimated to be a maximum of 7,000 acre-ft per year. (Knapp-USGS)
W69-03739

GROUNDWATER CONDITIONS AND GEOLOGIC RECONNAISSANCE IN THE UPPER SEVIER RIVER BASIN, UTAH,
Geological Survey, Washington, D. C.
C. H. Carpenter, G. B. Robinson, Jr., and L. J. Bjorklund.
Geol Surv Water-Supply Pap 1836, 1967. 91 p, 6 fig, 3 plate, 19 tab, 46 ref, index.

Descriptors: *Surface-groundwater relationships, *Pumping, *Permeability, Water table, Utah, Confined water, River Basins.
Identifiers: *Sevier River basin, Valley fill.

The four main valleys comprising the Upper Sevier River basin, Utah, were investigated to determine general groundwater conditions, the interrelation of groundwater and surface water, the effects of increasing the pumping of groundwater, and the amount of groundwater in storage. The valley fill, which is predominantly alluvium of sand, silt, and clay, has a maximum thickness of more than 800 ft. An average of about 25% of the valley fill is permeable sand and gravel which yields water readily to wells and springs. Groundwater occurs under both artesian and water-table conditions in all basins and subbasins. Along the sides and upstream ends of these basins, water is usually under water-table conditions. Additional water, although not readily available to wells, is stored in beds of silt and clay. Some groundwater also is available in the bedrock underlying and surrounding the basins, although the bedrock formations generally are poor aquifers. (Llaverias-USGS)
W69-03750

LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
Bureau of Reclamation, Sacramento, Calif.
Nikola P. Prokopovich, and David C. Magleby.
J Amer Water Works Ass, Vol 60, No 4, pp 413-424, Apr 1968. 12 p, 9 fig, 4 tab, 5 ref.

Descriptors: *Land subsidence, Central Valley Project, Groundwater, *Groundwater mining, Engineering geology, Alluvium, *Subsidence, Oil fields, Oil wells, Irrigation wells, Irrigation, Irrigation effects, Agriculture, *Overdraft, Settlement.
Identifiers: Central Valley (Calif), Gas production, *Overpumping, Irrigated agriculture.

Pleasant Valley is a young structural depression in the eastern foothills of California Coastal Ranges, with an alluvium blanket covering about 60 sq m. The regional geology and stratigraphy have been studied extensively, but little data are available on the stratigraphy and occurrence of the valley fill. The unconsolidated recent alluvium is several hundred feet thick and composed of interbedded sand, silt, and clay. Main causes of subsidence include: overdraft of ground water, withdrawal of crude oil and gas, oxidation and alteration of peat, and hydrocompaction. The first 2 causes are major contributors to the subsidence. Irrigation overdraft of ground water cannot explain subsidence in dry range lands surrounding the valley. Several oil and gas fields scattered around the valley are probably responsible for the minor subsidence in hills. Some subsidence in the valley in areas of oil fields could be partially related to the pumpage of oil and gas. Recent acceleration of subsidence in Coalinga, Calif., indicates that most subsidence is related to the overdraft of ground water. Comparisons of 1887 railroad elevations with 1955 elevations indicate about 4.5 ft subsidence at Coalinga and 7 ft subsidence in the Pasajero Gap during that interval. (USBR)
W69-03797

CITY OF FOND DU LAC V TOWN OF EMPIRE (VALIDITY OF MUNICIPAL ORDINANCE REGULATING THE DRILLING OF WELLS).

273 Wisc 333, 77 N W 2d 699-703 (1956).

Descriptors: *Wisconsin, *Municipal water, *Legislation, *Well regulations, Judicial decisions, Water law, Cities, Wells, Water sources, Water supply, Well casings, Drilling, Groundwater, Water wells, Overdraft, Legal aspects, Casings, Subsurface waters, Water utilization.
Identifiers: Ordinances.

This action was brought for a declaratory judgment as to the validity of a town ordinance which prohibited the drilling of a water well in the town with casings in excess of six inches in diameter except by permission of the town board. Such permission would only be granted upon a showing that the well would not adversely affect the availability of water for private wells in the town. The City of Fond Du Lac was trying to drill wells in the Town

of Empire for a new water source. The trial court held that the ordinance was invalid and the Supreme Court of Wisconsin affirmed because it conflicted with state statutes which indicated that the use of subterranean waters is a matter of statewide concern and which authorize a municipality to acquire necessary water supplies. (Watson-Fla)
W69-03902

GROVE LABORATORIES V FLOWOOD CORP (WELL WATER RIGHTS CONTRACT INTERPRETATION).
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03911

MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
Melbourne Univ., Parkville (Australia). Dept. of Geology.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03933

COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
California Univ., Davis. Dept. of Water Science and Engineering.
For primary bibliographic entry see Field 07C.
For abstract, see .
W69-03937

MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03938

WATER RESOURCES OF WISCONSIN, FOX-WOLF RIVER BASIN,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03939

SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
Bureau of Reclamation, Denver, Colo.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03941

FLUOROMETRIC PROCEDURES FOR DYE TRACING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03944

SP LOG INTERPRETATION IN SHALY SANDS,
Koninklijke/Shell Exploratie en Produktie Laboratorium, Rijswijk (Netherlands).
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03946

HYDROLOGIC DATA: 1967 - VOLUME 1: NORTH COASTAL AREA.
California State Dept. of Water Resources, Sacramento.

Calif Water Resources Bull No 130-67, Nov 1968. 79 p, 3 fig, 16 tab.

Descriptors: *Data collections, *Groundwater, *Surface waters, *Water quality, Water levels, Discharge (Water), California, Climatic data.
Identifiers: North Coastal Area (Cal).

Data on climate, surface water flow, groundwater levels, and surface-and groundwater quality are compiled for the North Coastal Area of California, 1967. Climate data include precipitation, temperature, and evaporation. Surface water data include daily stream discharges, gaging station locations, and summary tables of monthly and annual unimpaired runoff from major streams. Groundwater data consist of water level measurements from 50 wells and a table which summarizes the measurements. Water quality data include dissolved oxygen, pH, and temperature at the time of collection, as well as laboratory chemical analysis reports. (Knapp-USGS)
W69-03951

MINERAL AND WATER RESOURCES OF BARBOUR COUNTY, ALABAMA,
Alabama Geological Survey, University; and Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03952

ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES: 1. THICK SEDIMENTARY SEQUENCES,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03954

GEOLOGY AND GROUND-WATER RESOURCES OF THE MURPHY AREA, NORTH CAROLINA,
Geological Survey, Raleigh, N. C.
Chester L. Dodson, and R. L. Laney.
Groundwater Bull No 13, N C Dep Water and Air Resources, Aug 1968. 113 p, 17 fig, 18 tab, 16 ref.

Descriptors: *Water resources, *Groundwater, *North Carolina, *Hydrologic data, Water quality, Aquifers, Water level fluctuations, Water utilization.
Identifiers: *Murphy area (N C), Cherokee County (N C), Clay County (N C), Swain County (N C), Graham County (N C).

The groundwater resources of Cherokee, Clay, Graham, and Swain Counties, N. C., are described. The area is in the Blue Ridge physiographic province and is underlain by metamorphic rocks. The groundwater is in unconsolidated alluvium, fractures in metamorphic silicate rocks, and in solution cavities in marble. The rural population uses water from springs and wells. Recharge greatly exceeds the present water use of less than 1 1/2 mgd. Groundwater is soft and slightly acid, total dissolved solids concentration is less than 100 ppm, and iron concentration is less than 0.3 ppm. Maps show geology, the distribution of 5 quality-types of groundwater, and locations of wells and springs. Water level fluctuations are shown in observation well hydrographs. (Knapp-USGS)
W69-03959

GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER RESOURCE,
New Jersey Geological Survey, Trenton. Dept. of Conservation and Economic Development.
Kemble Widmer.
N J Bur Geol and Topogr, Geol Rep Ser No 8, 1968. 15 p, 2 fig, 1 tab, 11 ref. Published also in Proc of Int Conf on Water for Peace, Wash., D. C. May 23-31, 1967. (Vol 4, pp 915-925).

Descriptors: *Water resources, *Groundwater, *New Jersey, Aquifers, Geology, Water resources development, Water wells, Delaware River, Hudson River, Atlantic Ocean.
Identifiers: Groundwater provinces, Water resource peninsula.

Recent studies of groundwater geology published by the New Jersey Geological Survey were designed to provide information by which municipalities, counties, or regional planning groups can estimate the upper limits of groundwater resource in the area of interest. New Jersey is a water resource peninsula between the Delaware River and Bay on the west and the Hudson River and Atlantic Ocean on the east. Water development plans for New Jersey are limited to its own area and its share of any Delaware River development. The geologic conditions within the State establish 5 groundwater provinces with widely divergent potentials and problems. Three-fifths of New Jersey is a coastal plain whose low relief severely limits surface water development, while groundwater is abundant and easily utilized. Estimates of the groundwater potential should not only be based on the outcropping of a formation and the usual geologic and hydrologic factors, but also upon the area within which wells may be constructed to utilize the various sand formations. The northern 2/5 of the State are underlain by rock formations in 3 groundwater provinces where fissure water conditions prevail. The glaciated part of northeastern New Jersey forms a fifth groundwater province. The presence or absence and the character of the Pleistocene cover noticeably changes the groundwater potential of every underlying formation. Careful examination of large numbers of well records from any geologic formation indicates the safe sustained yield. From these estimates of safe sustained yield the minimum lot size for suburban development or the maximum population densities or industrial water need per sq mi can be determined from many areas of the state. (Knapp-USGS)
W69-03961

GEOHYDROLOGY OF THE SOURIS RIVER VALLEY IN THE VICINITY OF MINOT, NORTH DAKOTA,
Geological Survey, Washington, D. C.
Wayne A. Pettyjohn.
Geol Surv Water-Supply Pap 1844, 1967. 53 p, 16 fig, 3 plate, 5 tab, 14 ref.

Descriptors: *Hydrogeology, *Groundwater, *Aquifers, Confined water, North Dakota, Artificial recharge, Natural recharge, Transmissivity.
Identifiers: *Minot Aquifer, Souris River.

Detailed geohydrologic data are presented on the Minot aquifer, a deeply buried glaciofluvial deposit of sand and gravel containing large amounts of clay. Water occurs in this aquifer under both artesian (confined) and water-table (unconfined) conditions. The maximum coefficient of transmissibility was determined as 250,000 gpd per ft. Recharge is by lateral movement in the aquifers from adjacent buried glaciofluvial channels and from Souris River seepage. Natural recharge probably averages about 3 mgd. In 1963, 13 municipal wells pumped an average of nearly 4 mgd from the Minot aquifer, but since the first municipal well began pumping in 1916, the water level has declined more than 70 ft. This rapid decline is indicative of a future serious water shortage, which may be overcome by artificial recharge from the western part of Minot. (Llaverias-USGS)
W69-03969

GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
Geological Survey, Washington, D. C.
George E. Siple.
Geol Surv Water-Supply Pap 1841, 1967. 113 p, 37 fig, 6 plate, 15 tab.

Descriptors: *Hydrogeology, *Aquifers, *Storage coefficient, *Water quality, Water level fluctuations, Water supply, Transmissivity, Recharge, South Carolina.
Identifiers: *Savannah River nuclear processing plant.

To provide the Atomic Energy Commission with geohydrologic data relating to the construction and operation of the Savannah River nuclear

processing plant, an evaluation is presented on the geology, hydrology, groundwater chemistry, and water-level fluctuations of the area. The principal aquifer is recharged by leakage, and can supply 10,000 gpm for operating the plant without exceeding the allowable drawdown in existing (1960) production wells. Pumping of wells screened in the Tuscaloosa Formation indicate values for the coefficient of transmissibility from 34,000 to 400,000 gpd per ft; for the coefficient of storage, from 0.0002 to 0.0008; and for the coefficient of permeability, from 360 to 1,500 gpd per sq ft. Water from the Tuscaloosa Formation has a low amount of mineralization, is quite soft, but slightly acidic. The disposal of radioactive waste has not seriously affected the quality of groundwater. (Laverias-USGS)
W69-03970

INVESTIGATION OF THE KARSTIC WATER RESERVES BURIED UNDER MIOCENE, PLIOCENE, AND QUATERNARY SEDIMENTS OF THE MEDITERRANEAN BASIN (FRENCH),
Montpellier Univ. (France).
Jacques Avias.
Symp of Dubrovnik, Int Ass Sci Hydrol, 1965. 10 p, 7 fig, 4 ref.

Descriptors: *Water resources, *Groundwater basins, *Hydrogeology, *Karst, *Water resources development, Aquifers, Artesian wells, Water quality, Water supply.
Identifiers: Mediterranean basins, Languedoc-Roussillon (France).

The calcareous and dolomitic massifs of the Mediterranean basin are described as unusually fissured and karstified. This phenomena depends to a large extent on the tectonic alpine movements affecting the levels of the ancient seas and on the Mediterranean climate characterized by the concentration of rainfall, the conditions usually adding to the formation of water traps. The use of geological, geophysical (seismic, electric) and various borehole methods in the Languedoc-Roussillon area resulted in the discovery of excellent aquifers under a sedimentary cover. It is concluded that important reserves for future water supplies may be found eventually in the karstic formations of the Mediterranean basin provided the geologic formations have never been associated with the seas and are not subject to saline water encroachment. (Gabriel-USGS)
W69-03972

GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
Geological Survey, Washington, D. C.
Donald L. Coffin, and Albert C. Horr.
Geol Surv Water-Supply Pap 1843, 1967. 49 p, 10 fig, 1 plate, 5 tab, 20 ref.

Descriptors: *Water management (Applied), *Colorado, Water quality, Groundwater movement, Hydrogeology, Aquifer characteristics, Water storage.
Identifiers: *Big Sandy Creek Valley, Lincoln, Cheyenne and Kiowa Counties (Colo).

In order to determine the availability of groundwater, the extent of groundwater development, the chemical quality of water as related to use, and the present and possible future groundwater problems, a study was undertaken of the Big Sandy Creek valley, Colorado. The valley-fill deposits constitute the major aquifer and yield as much as 800 gpm to wells; maximum well yields in the tributary valleys are about 200 gpm and average 5 to 10 gpm. The dune sand and upland deposits yield little water because of drainage. Direct precipitation and infiltration of floodwater are chief sources of the groundwater reservoir, and floods are a major source of recharge. Surface-water irrigation has been unsuccessful because of the failure of diversion dams and because of excessive seepage from reservoirs. Groundwater is suitable for most purposes, but the water yield from wells is slight. (Laverias-USGS)
W69-03974

ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
Geological Survey, Washington, D. C.
Gordon D. Bennett, Ata-ur- Rehman, Ijaz Ahmed Sheikh, and Sabir Ali.
Geol Surv Water-Supply Pap 1608-G, p Gl-G56, 1967. 56 p, 23 fig, 1 plate, 3 tab, 5 ref.

Descriptors: *Aquifer characteristics, *Pumping, *Flow characteristics, Permeability, Drawdown, Water yield.
Identifiers: *West Pakistan, Punjab Plain, Unconfined flow.

Analytical results are presented of 141 aquifer pumping tests in the Punjab Plain of West Pakistan. The assumptions underlying the methods used are detailed, and the general theory of unconfined flow to wells is outlined. Data on the lateral permeability of the screened interval, the specific yield of the material at water-table depth for 106 tests, and the vertical permeability of the material between the water table and the top of the screen for 14 tests are reported. (Llaverias-USGS)
W69-03975

WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
Geological Survey, Washington, D. C.
Donald R. Albin, Marion S. Hines, and J. W. Stephens.
Geol Surv Water-Supply Pap 1839-G, pp Gl-G29, 1967. 29 p, 7 fig, 3 plate, 9 tab, 19 ref.

Descriptors: *Water resources development, *Water utilization, Wells, Flow characteristics, Water quality, Surface-groundwater relationships, Water yield.
Identifiers: *Jackson and Independence Counties (Ark).

Technical details are provided on a water resources investigation in Arkansas to determine the availability of water for municipal, industrial, irrigation, and domestic uses. It was found that supplies for these large-scale uses can be obtained from wells in the Coastal Plain and from streams in the highlands. When screened at depths from 100 to 150 ft in alluvial sand and gravel of Quaternary age, wells will yield 1,000-2,000 gpm of water, requiring treatment to remove iron and eliminate hardness. Small tributary streams of the White River, and the flow of Polk Bayou may be utilized and require only slight storage facilities. Dependable supplies can be obtained from streams in the Boston Mountains and in the Arkansas Valley by constructing storage facilities. Although hard, water from all highland streams is of excellent chemical quality. (Llaverias-USGS)
W69-03976

WINTER THAWS CAN RAISE GROUND WATER LEVELS IN DRIFTLESS AREA,
Forest Service (USDA), St. Paul, Minn. North Central Forest Experiment Station.
Richard S. Sartz.
U.S.D.A. Forest Serv. Res. Note NC-35, 1967. 2 pp.

Descriptors: *Springs, *Groundwater, *Frozen ground, *Infiltration, *Groundwater recharge, Precipitation (Atmospheric), Aquifers, Hydrologic cycle, Fluctuation, Soil water, Distribution patterns, Snow cover.

Springflow and ground water levels both rose with winter thaws, even when the ground was frozen. A high soil water content suggests that water moved to the water table through a continuous column of soil water rather than as a wetting front.
W69-04015

DISPERSION OF RADIOACTIVE TRACERS IN A MODEL BASIN SANDY AQUIFER,
Middle Eastern Regional Radioisotope Centre for the Arab Countries, Cairo (Egypt).
I. B. Hazzaa, R. K. Girgis, and S. M. Refaei.
Bulletin of the International Assoc of Scientific Hydrology, pp 75-81, December 1967. 4 fig, 2 tab.

Descriptors: *Tracers, *Sands, *Aquifers, *Iodine radioisotopes, *Dispersion, Radioisotopes, Wells, Groundwater movement, Model studies, Pumping, Porosity, Watersheds (Basins), Tracking techniques, Piezometers.

Controlled conditions for a model basin sandy aquifer were described. Experiments were carried out on three observation wells. Four different rates of pumping were tried on the central well. Radioactive iodine was used as the tracer. Effective porosity determinations showed that the time of the first arrival of radioactive tracers injected in an observation well to a pumped well should be considered in porosity calculations. The tests showed an increase of the dispersion of tracers with the increasing of the distance of their path and lowering of the discharge rate. The methods and procedures that were used in the study could be used to determine properties of sandy aquifers which are found in arid climates. (Blecker-Ariz)
W69-04111

GROUND WATER AND COMPUTER SIMULATIONS,
TRW Systems Group, Redondo Beach, Calif.
M. L. Frankel.
J Amer Water Works Ass, Vol 59, No 11, pp 1360-1369, Nov 1967. 10 p, 2 fig.

Descriptors: *Simulation analysis, *Water supply, *Groundwater basins, Hydraulic properties, Hydrologic budget, Networks, Mathematical models, Surface waters, Analytical techniques, Water management (Applied).

The role of computer simulation of groundwater systems in the planning of water resources development was discussed. The use of groundwater as a supply source in the past, present and future was described. The characteristics of groundwater flow and the basis for simulation models were outlined. Models were of the network-node flow type, with the equations for flow between nodes based on Darcy's Law and the law of conservation. Surface water simulation was briefly described. Solution methods such as iterative relaxation techniques, the Hardy-Cross and Newton-Raphson techniques, were outlined. Water demand models based on a Cobb-Douglas-type demand function, and the importance of fitting of coefficients for this type of model, were discussed. It was concluded that simulation was a valuable tool for water management. (Gysi-Cornell)
W69-04149

2G. Water in Soils

THEORETICAL ANALYSIS OF TWO-DIMENSIONAL, TRANSIENT FLOW OF WATER IN UNSATURATED AND PARTLY UNSATURATED SOILS,
Geological Survey, Menlo Park, Calif.
J. Rubin.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 607-615, Sept-Oct 1968. 9 p, 10 fig, 18 ref, 1 append.

Descriptors: *Unsaturated flow, *Infiltration, *Soils, Drainage, Darcys law, Hydraulic conductivity, Mathematical models, Digital computers, Approximation method.
Identifiers: Implicit difference methods.

The Darcian flow-equation for two-dimensional, transient transfer of water in rectangular, unsaturated or partly unsaturated soil slabs was solved numerically with the aid of alternating-directions, implicit difference methods. Two alternative processes were considered: predominantly horizontal infiltration and ditch-drainage. The results ob-

tained for the horizontal infiltration process indicate that it involves upward flow-components which are due, primarily, to a gravity-induced variation in hydraulic conductivity along the inflow face. These components may materially affect the course of infiltration, especially during its earlier stages. The drainage case results demonstrate that transient water flow within the unsaturated zone and the outflow from the seepage zone may significantly affect the progress of water-table descent and the total outflow rates.
W69-03736

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE I THEORY AND EXPERIMENT,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
C. W. Rose.
Aust J of Soil Research, Vol 6, No 1, pp 31-44, July 1968. 14 p, 10 fig, 28 ref, append.

Descriptors: *Water transfer, *Soil water movement, *Soil temperature, *Moisture content, Soil profiles, Radiation, Diurnal, Fluctuation, Equations, Volumetric analysis, Diffusivity, Vapor pressure, Hydraulic conductivity, Thermal conductivity, *Thermocline.
Identifiers: Water transport.

Temperature gradients can result in moisture movement in soil. An experiment was described in which profiles of water content and temperature were measured in the top 15 cm. of bare loamy sand for a period of 6 days following saturation. The theory of water transport in soil was summarized for situations where flux can arise from gradients in temperature as well as in soil water suction and gravitational potential. Soil data was examined with respect to moisture characteristics, bulk density, vapor diffusion characteristics, hydraulic conductivity and diffusivity. For all but the lowest sampling depths there was, superimposed on a regular decline in a water content, an approximately sinusoidal fluctuation of daily period. As moisture characteristics were practically constant over the depth of measurement, water content profiles indicated an upward liquid movement of water both by day and by night. Temperature flux plays a part in water movement in arid soils. See also Part II, W69-03870. (Blecker-Arizona)
W69-03869

WATER TRANSPORT IN SOIL WITH A DAILY TEMPERATURE WAVE II: ANALYSIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research.
C. W. Rose.
Aust J of Soil Research, Vol 6, No 1, pp 45-57, July 1968. 13 p, 2 fig, 2 tab, 26 ref.

Descriptors: *Water transfer, Vapor pressure, *Soil temperature, *Soil profiles, *Fluctuation, Diurnal, *Thermocline, Equations, On-site investigations, Soil water movement, Analytical techniques, Hydraulic conductivity, Moisture content.
Identifiers: Vapor flux, Liquid flux, Error analysis.

The results of a field experiment investigating water transport in soil with a strong daily temperature wave were analysed. Net vapor flux densities in different soil profile layers were of comparable magnitude that enabled them to be transferred into the liquid phase. The hypothesis of the existence of a vapor flux in the soil of a magnitude comparable with the liquid flux was examined quantitatively. Two possible vapor flux enhancement mechanisms with daily periodicity were discussed with respect to their making a significant contribution to vapor flux under the conditions of the experiment that was conducted. In a hot, arid climate, a discontinuous liquid phase can enhance vapor phase transport over the rate expected if both solid and liquid phases are regarded as a barrier to such movement. See also Part I, W69-03869. (Blecker-Arizona)
W69-03870

MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
Agricultural Research Service, Mandan, N. Dak.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03871

INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
Nevada Univ., Reno. Renewable Resource Center.
Gerald F. Gifford, and C. M. Skau.
Proc Third Annul Amer Water Resources Conf, pp 137-148, 1967. 12 p, 2 fig, 3 tab.

Descriptors: *Cultural control, *Runoff, *Sediment discharge, Crop response, *Sagebrush, *Nevada, Range management, Treatment, Peak discharge, Infiltration, Infiltrometers, Rainfall simulators, Soil profiles, Regression analysis, Variability, Mathematical studies.
Identifiers: Macroplots, Paramenters, Eastgate Basin (Nev), Replications.

The influence of various cultural practices on runoff and sediment production in the big sagebrush (Artemisia Tridentata) was studied in the first year of treatment response in Eastgate Basin, Nevada. Two sites with varying elevation, average slope and soil characteristics were utilized. Influence of site and condition of plot (dry or wet) were significant during all aspects of infiltrometer runs. Treatment influenced certain aspects of the infiltrometer run: time from start of infiltrometer run to when runoff exceeded 0.1 in./hr and infiltration rates after 10, 15, and 20 min. Sediment yield and peak sediment discharge rates were variable. Multiple regression analysis of plot factors influencing hydrologic behavior during infiltrometer runs revealed importance of cover, soil texture, condition of plot and rock in 0-1 in. or 1-4 in. of soil. Indications were made that cultural activity in plant communities should be undertaken where site potential suggests improvements. (Affleck-Arizona)
W69-03873

EVAPORATION FROM AN EPHEMERAL STREAMBED,
Geological Survey, Denver, Colo. Water Resources Div.; and Arizona Univ., Tucson. Dept. of Agricultural Engineering.
Michael L. Sorey, and William G. Matlock.
J of Hydraulics Div, ASCE, Vol 95, No HY1, Proc Paper 6368, pp 423-438, Jan 1969. 16 p, 10 fig, 6 tab.

Descriptors: *Evaporation, *Ephemeral streams, Arizona, *Water loss, *Streambeds, *Sands, Evaporation pans, Diurnal, Water table, Wetting, Semiarid climates, Sampling, Moisture content, Drying, Channels, Sediments, Particle size, Seasonal.
Identifiers: *Tucson (Arizona).

In Tucson, Arizona daily evaporation was measured for sands that dry without contact with a water table. Selected sands from an ephemeral streambed were packed in cylinders, wetted, and weighed to determine evaporation loss under field climatic conditions. In summer and early fall tests, first day evaporation from the sands was less than half the loss from an adjacent Class A Weather Bureau Pan. During the first week, evaporation rates for the sands were lower than those reported for irrigated soil. The maximum depth of drying during the three-week tests was less than 1 foot. The results of these tests were used to estimate the volume of water lost annually by streambed evaporation in the Tucson area. (Affleck-Arizona)
W69-03874

THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
State Research Farm, Werribee (Australia).
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03875

ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03879

CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
Agricultural Research Service, Akron, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03880

LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
Agricultural Research Service, Akron, Colo. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03881

WATER FLUX IN MOIST SOIL: THERMAL VERSUS SUCTION GRADIENTS,
Department of Agriculture, Washington, D. C.
J. W. Cary.
Soil Science, Vol 100, No 3, pp 168-175, Sept 1965. 8 p, 2 fig, 2 tab, 18 ref.

Descriptors: *Soil moisture, *Thermal properties, *Heat flow, Water properties, Latent heat, *Water circulation, Soil temperature, Water transfer, *Unsaturated flow, Fluctuation, Thermocline, Conductivity, Heat transfer, Thermal conductivity, Vapor pressure, Equations, Liquids.
Identifiers: Moisture transport.

This experiment was designed to yield data defining the relative importance of thermal gradients in transporting soil moisture and to probe mechanisms of transfer. An apparatus was built to measure simultaneous fluxes of heat and moisture across an unsaturated soil sample. Net moisture flux was the sum of two components: flowing due to pressure difference and that due to thermal difference. Most of the rise in heat flux at higher average temperatures was due to transfer of latent heat of vaporization as the vapor flow increased. A temperature gradient of 0.5 degrees C. per cm. at a soil moisture suction of 5 cm. of mercury moved as much water through the soil as a pressure gradient of 2 cm. of water per cm. A linear thermodynamic moisture flux equation was developed in terms of commonly used flow coefficients and variables. A mechanism for unsaturated flow in the liquid phase through soil was proposed. Water flux in moist soil in arid climates could be measured using methods and procedures outlined in the study. (Blecker-Arizona)
W69-03883

SOME STUDIES OF SENSIBLE AND LATENT HEAT FLUXES AT WALTAIR, SOUTHEASTERN COAST OF INDIA,
Meteorological Service of Canada, Toronto (Ontario).
R. J. Polavarapu.
Agric Meterol, Vol 5, No 4, pp 255-268, July, 1968. 14 p, 10 fig.

Descriptors: Energy budget, Soil moisture, *Latent heat, Heat transfer, *Heat balance, *Fluctuation, Moisture content, Diurnal, Annual, Seasonal, *Variability, *Radiation, Monsoons.

Identifiers: *Bowen ratio, *Sensible heat, India, Hourly, Halstead's model, *Heat fluxes.

Sensible and latent heat fluxes were estimated over a 22-month period at Waltair, India using three methods: Halstead's model of non-equivalence of turbulent transfer coefficients, the classical concept of equivalence of turbulent transfer coefficients, and by use of the Bowen ratio. Halstead's method gave the best evaluation of sensible and latent heat fluxes. Agreement of fluxes obtained by the Bowen ratio method and Halstead's method was best during daytime and poor during night time. The diurnal, seasonal, and annual variation of the sensible and latent heat fluxes were discussed. A relation between the Bowen ratio and the mean moisture content of the top 30-cm soil layer was established. The Bowen reached a limiting value as the moisture content in the soil increased to field capacity. (Affleck-Arizona)
W69-03887

SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03935

MODEL STUDY OF BOUNDARY EFFECTS ON DITCH DRAINAGE,
North Carolina State Univ., Raleigh. Dept. of Biological and Agricultural Engineering.
Eugene W. Rochester, and George J. Kriz.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6313, pp 493-504, Dec 1968. 12 p, 8 fig, 19 ref, append.

Descriptors: *Furrow drainage, *Hydraulic models, *Impervious soils, *Subsurface drainage, Anisotropy, Seepage, Water table, Dimensional analysis.
Identifiers: *Hele-Shaw models, Ditch drainage.

A Hele-Shaw model was used to evaluate the influence of the depth to an impermeable layer on transient subsurface drainage into equally spaced open drains. The results indicate that a horizontal impermeable layer affects drainage significantly only if the layer is closer to the ditch bottom than one-twelfth the ditch spacing. The initial depth of water above the ditch bottom does not affect this criteria. The midpoint recession of the free surface is exponential if the flow is not affected by the impermeable layer. Some dimensionless groupings are valid only if the ditch bottom extends to the impermeable layer.
W69-03938

SUBSURFACE DRAINAGE BY TRANSIENT-FLOW THEORY,
Bureau of Reclamation, Denver, Colo.
Lee D. Dumm.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6315, pp 505-519, Dec 1968. 15p, 12 fig, 6 tab, 13 ref.

Descriptors: *Subsurface drainage, *Mathematical studies, *Unsteady flow, *Drawdown, Groundwater, Seepage, Discharge (Water), Irrigation, Water balance, Hydrologic budget, Evapotranspiration.
Identifiers: Drain spacing, Transient flow theory.

The transient-flow theory is used as a basis for determining spacing relationships of subsurface drains. Steady-state flow theory does not adequately describe the changing conditions of subsurface drainage. Research work from Australia and Canada and data from a Bureau of Reclamation project were used for checking the validity of the mathematical developments of the transient-flow theory under many varying field conditions. An actual field problem is given as an example of how field investigational data and other available data are used in developing drain-spacing requirements under various specified conditions. Discharge formulas are given and their validity is verified by the Australian and Canadian research work.
W69-03941

FLUID FLOW AND PORE-WALL ADSORPTION RELATIONSHIP: THE EFFECT OF TENSION AGENTS (FRENCH),
Montpellier Univ. (France. Inst. of Geology.
Jacques Avias, and Christian Armangau.
Genie Chimique, Vol 95, No 5, pp 1033-1040, May 1966. 8 p, 4 fig, 15 ref.

Descriptors: *Fluid flow, *Capillary action, *Detergents, *Adsorption, *Surface tension, *Pourous media, Infiltration, Pores, Wettability, Percolation, Water treatment, Hydrologic properties, Solubility, Flow resistance, Surfactants.
Identifiers: *Tension agents effect.

Laboratory and field experiments were conducted to evaluate the effects of tension agents on water permeability of natural porous media such as sand, calcareous tufa, etc, and on the water-permeability of artificial material (sintered glass). The study shows that the addition of tension agents (detergents) modifies the permeability of porous media by increasing this permeability in rocks of high permeability and decreasing it in rocks characterized by low water-adsorption. No inverstion permeability was observed as a function of the medium type. The study of the speeds of sedimentation of various size of particles by adding various tension agents has served to better elucidate the adsorption phenomenon. (Gabriel-USGS)
W69-03973

LEACHING REQUIREMENT FOR EXCHANGEABLE-SODIUM CONTROL,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Rhoades.
Soil Sci Soc Amer Proc Vol 32, No 5, pp 652-656, Sept-Oct 1968. 4 fig, 2 tab, 16 ref.

Descriptors: *Irrigation water, *Sodium, *Leaching, *Cation exchange, *Equations, Drainage water, Water quality, Saline water, Salts, Root zone, Permeability, Adsorption, Soil water, Salinity, Arid lands, Lime, Salt tolerance.
Identifiers: *Leaching requirement, Sodium adsorption ratio, Sodium hazard.

Estimation of the leaching fraction required to maintain the SAR (Sodium-Adsorption Ratio) in irrigation water at the lower limit of the plant-rooting zone below some limiting value was described. Plant tolerances to sodium and soil permeability regulate the limiting SAR. Prediction of SAR values for a calcareous soil was accomplished by use of a formula equating the leaching requirement for salinity control from irrigation and soil waters. (Affleck-Ariz)
W69-04012

CONCEPTS IN HYDROLOGIC SOIL GROUPING,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
H. N. Holtan, Charles B. England, and Vernon O. Shanholtz.
Trans Amer Soc Agr Engin, Vol 10, No 3, pp 407-410, 1967. 2 tab, 4 fig, 8 ref, 4 p.

Descriptors: *Infiltration, Physical properties, Porosity, *Soil groups.
Identifiers: *Infiltration model, Storage depletion.

Infiltration is derived as a function of physical characteristics of soils readily available from soil survey data. Volumes of gravitational water and plant-available water provide upper limits of infiltration recovery by drainage and evapotranspiration, respectively, in computations of the hydrologic performance of a soil over an extended period of time. (England-USDA Hydro Lab)
W69-04013

GEOLOGY OF CLEMSON RESEARCH WATERSHED,
Clemson Univ., S. C.
J. R. Lambert, P. K. Birkhead, and T. V. Wilson.
Clemson University Water Resources Research Institute, Report No. 9. 21 p, 5 tab, 6 fig. OWRR Project A-003-SC.

Descriptors: *Geologic mapping, Soil investigations, Seismographs.

The geology of the 561-acre watershed near the Clemson University campus was investigated using a portable seismograph and a power auger. Topographic and lithologic and soils maps indicate rock types and water table elevations, and the various soils by slope, erosion, type and capability. Valley cross-sections indicate the general relationships among overburden, bedrock, and water tables.
W69-04018

A METHOD OF DETERMINING HYDRAULIC CONDUCTIVITY CHARACTERISTICS FOR NON-SWELLING SOILS IN SITU, AND OF CALCULATING EVAPORATION FROM BARE SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Land Research; and Central Arid Zone Research Inst., Jodhpur (India).
C. W. Rose, and A. Krishnan.
Soil Science, Vol 103, No 6, pp 369-373, June 1967. 3 fig, 1 tab, 9 ref.

Descriptors: *Measurements, *Hydraulic conductivity, *Evaporation, *Soil water, *Moisture content, Arid lands, Depth, Pores, Sands, Profiles.
Identifiers: Soil matrix, Non-swelling soils, Bare soil, In situ, India, Iterative method.

This paper described a method of determining hydraulic conductivity of arid soil in situ as a function of depth and water content for non-swelling soils in which moisture characteristics reflected distribution of pore sizes within the soil matrix. The method was illustrated for data obtained on a sandy soil at the Central Arid Zone Research Institute, India. The method required a series of consecutive measurements of water-content profiles. Soil-water suction could be measured in situ or inferred from water content and moisture characteristics determined in the laboratory. Calculation of hydraulic conductivity required the knowledge of evaporation from bare soil during the measurement period. A rapidly convergent iterative method was described for estimating that evaporation and therefore of calculating conductivities. (Blecker-Ariz)
W69-04114

SOIL WATER TRANSLOCATION IN A HIGH WATER TABLE AREA,
Agricultural Research Service, Mandan, N. Dak.
L. C. Benz, W. O. Willis, F. M. Sandoval, and R. H. Mickelson.
Water Resources Research, Vol 4, No 1, pp 95-101, June 1968. 6 fig, 2 tab, 18 ref.

Descriptors: *Soil water, *Water table, *Soil temperature, *Confined water, *Translocation, Soil water movement, Specific yield, Saline soils, Mulching, Soil surfaces, Thermocline, Winter, Freezing, Soil profiles, Climatic data.
Identifiers: *Straw.

This paper reports results of a field experiment conducted to evaluate soil water, water table and soil temperature relationships in an area having a high water table, saline soil and artesian water. Soil surface treatments were straw cover and no cover--both without cropping. Soil water content increased during winter, depending on the surface treatment. Average water content of the soil profile increased more than the amount of water theoretically available on the basis of the specific yield and the corresponding water table drop. The additional water was apparently obtained from artesian ground water. Changes in soil water content and

water table depth were associated with soil temperature. Soil moisture conditions studied in this report are characteristic of arid lands. (Blecker-Ariz)
W69-04124

DETERMINATION OF THE SOLUBILITY PRODUCT OF SOIL CONSTITUENTS SUCH AS GYPSUM,
Sydney Univ. (Australia). Dept. of Soil Science.
Joan M. Rance, and B. G. Davey.
Soil Sci Amer Proc Vol 32, No 5, pp 670-672, Sept-Oct 1968. 2 tab.

Descriptors: *Solubility, *Gypsum, Calcium sulfate, Saline soils, Arid lands, Soil chemistry, Ions, Equations, Absorption, Spectroscopy.
Identifiers: *Solubility product.

A converging cyclic procedure involving use of a published value for the dissociation constant for gypsum, an experimentally derived value for total Ca concentration and the second approximation of the Debye-Huckel equation was utilized to calculate the solubility product of gypsum at 20 deg C. Atomic absorption spectroscopy was used to determine total Ca concentration. The solubility product of CaSO sub 4 using this method was 2.4 times 10 to the minus 5th power. Ion pairs comprised 32.1% of total soluble Ca. Gypsum is a common constituent of soils of arid regions, and is used in the reclamation of saline soils and as a fertilizer. (Affleck-Ariz)
W69-04127

MEASURING THE RELATIVE HUMIDITY OF SOILS AT DIFFERENT MOISTURE CONTENTS BY THE GRAY HYDROCAL HYDROMETER,
Michigan State Univ., East Lansing.
George J. Bouyoucos, and Ray L. Cook.
Soil Science, Vol 104, No 4, pp 297-305, July 1968. 6 fig, 6 tab, 9 ref.

Descriptors: *Moisture content, *Hygrometry, *Humidity, *Soil moisture, *Instrumentation, Soil physics, Moisture tension, Saline soils, Silts, Loam, Clays, Calibrations, Measurements.
Identifiers: Gray hydrocal hygrometer, Relative humidity, Sensors, Non-saline soils.

A gray hydrocal hygrometer was used to measure relative humidity of soils at different moisture contents. Data were obtained for a silty clay, silt loam, lateritic clay, clay loam and sandy loam soils. The hygrometer had a range of 10-100%. Tremendous soil moisture tension forces were shown at the various moisture contents. A high degree of sensitivity and consistency was revealed by the hydrocal sensor. The hydrocal hygrometer was capable of measuring both the relative humidity and the soil-moisture tension of saline and non-saline soils. (Blecker-Ariz)
W69-04130

2H. Lakes

BIOLOGICAL STUDIES OF MANGANESE SOLUTION FROM ITS DIOXIDE,
Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
Robert S. Ingols, and Mine E. Enginun.
Cosponsor: Water Res Center, Georgia Inst of Technology. Symp on Trace Inorg in Water, Advance in Chem Ser, No 73, pp 143-148, 1968. 6 p, 3 fig, 5 ref.

Descriptors: *Aqueous solutions, *Biochemistry, *Manganese, *Bacteria, *Lakes, Leaching, Soils, Coliforms.
Identifiers: Bacterial manganese reduction, Book.

Studies of the solution of manganese from manganese dioxide by reaction with sterile and inoculated bacterial media indicate that the inoculation is unnecessary for the solution. Actually, the growing organisms compete for the reactive capacity of the food in the medium; the more rapidly that the organisms develop the greater is the competitive interference. Under natural conditions, the organisms contribute to the manganese solution by developing an oxygen free environment for the maintenance of a manganous solution at the neutral pH values typical of natural lakes.
W69-03725

EVAPORATION STUDY AT SHARP STATION POND NEAR BATON ROUGE, LOUISIANA,
Geological Survey, Baton Rouge, La.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03731

EVAPORATION OF WATER: ITS RETARDATION BY MONOLAYERS,
Columbia Univ., New York. Dept. of Mineral Technology; and Calif. Univ., Berkeley. Dept. of Mineral Technology.
For primary bibliographic entry see Field 03B.
For abstract, see .
W69-03884

HEITSCH V CLARK (INJUNCTION TO ENJOIN CHANGE IN LAKE LEVEL).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03901

THE GREAT LAKES WATER LEVELS PROBLEM,
United States Lake Survey, Detroit, Mich. Engineering Div.
Ben G. DeCooke.
Limnos, Vol 1, No 1, pp 22-26, Spring 1968. 5 p, 1 map, 1 tab.

Descriptors: *Great Lakes, *Water level fluctuations, *Hydrologic budget, Legal aspects, Economic justification, Regulation, International Joint Commission.
Identifiers: *Water level regulation.

Because of public concern over water level fluctuation in the Great Lakes, a study is being made of the water budget of the system so that lake-level regulation may be planned. The outflow of Lake Superior has been regulated since 1921 and Lake Ontario since 1960. Riparian interests desire reduction of duration and height of high stages. High water in 1951 caused damages of about $61 million, about 80% of which was caused by wave action. No costs are available for low-water damages, but riparian interests also desire low-water control. Navigation interests need relatively high minimum levels to allow greater draft for vessels. The Corps of Engineers estimates that raising minimum levels 1-1 1/2 ft in Lake Michigan-Huron would benefit navigation by about $1 million per yr. Power interests desire generally high stages to provide greater head and storage and to insure proper ice cover and flow in winter. Because of large natural variation in input, regulation for absolutely constant level is impractical. Some degree of regulation of the system is feasible from an engineering point of view, but the economic justification has not been determined. A cost-benefit study is being made. (Knapp-USGS)
W69-03947

CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
California Univ., Berkeley. Dept. of Geology and Geophysics.
Richard L. Hay.
Contrib Mineral and Petrol, Vol 17, No 4, pp 255-274, 1968. 20 p, 8 fig, 2 tab, 13 ref.

Descriptors: *Chemical precipitation, *Chert, *Lakes, Carbonates, *Silicates, Colloids, Leaching, Igneous rocks, Zeolites.
Identifiers: *Africa, Kenya, Tanzania, Lake Magadi, Lake Natron, Magadiite, Kenyaite.

Chert has formed from two sodium-silicate minerals, magadiite and kenyaite, in uppermost Pleistocene deposits of lakes Magadi and Natron in Kenya and Tanzania. The chert consists of finely crystalline quartz and characteristically forms nodules of irregular shape with white coatings having reticulate surface patterns. Similar nodules are widespread in lower and middle Pleistocene lacustrine deposits in the vicinity of Lake Magadi, Lake Natron, and Olduvai Gorge. Although magadiite and kenyaite are absent in the lower and middle Pleistocene deposits, the chert in these beds probably formed from a sodium-silicate precursor. All of the chert-bearing sediments were deposited in saline, alkaline lakes rich in dissolved sodium carbonate-bicarbonate. Magadiite (and chert) may form either thin, widespread deposits or localized masses which may be cross-cutting. Thin, widespread layers of magadiite have been precipitated by mixing of silica-rich brine with fresh water in a chemically stratified lake; localized masses may have been formed by interaction of brine with fresher water entering the floor or margin of the lake. Magadiite and kenyaite can alter to chert in contact with sodium-carbonate brine and possible by leaching with relatively fresh water over a period of 20,000 years or less. The siliceous zeolites clinoptilolite and erionite predominate in trachyte tuffs associated with magadiite and chert; less-siliceous phillipsite predominates in trachyte tuffs of chert-free sequences.
W69-03955

PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
Robert S. Kerr Water Research Center, Ada, Okla.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03960

RELATION BETWEEN DEPTH FOR MAXIMUM AMOUNT OF EXCESS OXYGEN DURING THE SUMMER STAGNATION PERIOD AND THE TRANSPARENCY OF FRESHWATER LAKES OF JAPAN,
College of Science and Literature, Tokyo (Japan). Geographical Inst.
Shinkichi Yoshimura.
Proc Imperial Acad Japan, Vol 11, No 9, pp 356-358, 1939. 2 fig, 1 tab, 2 ref.

Descriptors: *Limnology, *Light penetration, *Photosynthetic oxygen, *Stratification, Lakes, Oligotrophy, Oxygen, Phytoplankton, Estimating equations.
Identifiers: *Transparency, *Japan, Metalimnetic maxima, Trophic layer, Tropholytic layer, Compensation depth, Lake Wakuike, Lake Masyuko, Lake Tazawako.

Author reports data on maximum depth, transparency (depth of disappearance of white disc), and depth of occurrence of maximum photosynthetically produced oxygen concentrations during stratification for 37 Japanese lakes. Maximum depths range from 7 (Lake Wakuike) to 425 meters (Lake Tazawako); transparencies, 0.8 (Lake Wakuike) to 41.6 meters (Lake Masyuko); and depths of maximum oxygen concentrations, 1.5 (Lake Wakuike) to approximately 50 meters (Lake Masyuko). Transparencies reported correspond with depth to which 16% of surface light penetrates. Analysis of the data led to the conclusion that compensation depth between trophic and tropholytic layers is close to the depth of oxygen maximum. Plot of transparency versus depth of maximum oxygen concentration results in a reasonably linear relationship in which compensation depth equals 1.5 times the transparency. (Eichhorn-Wis)
W69-04019

LIGHT PENETRATION INTO FRESH WATER,
W. H. Pearsall, and Philip Ullyott.

J Exp Biol, Vol 11, pp 89-93, 1934. 3 fig, 1 tab, 8 ref.

Descriptors: *Lakes, *Limnology, *Light penetration, *Vegetation, *Phytoplankton, Aquatic plants, Optical properties, Seasonal, Light penetration, Cyanophyta, Diatoms, Light.
Identifiers: *Lake Windermere (England), English lake district, Photoelectric cells, Transparency, Light measurements.

From March 1932 to March 1933, authors took more than 70 series of readings of light penetration in Lake Windermere, England, using a vacuum potassium-on-copper photoelectric cell and potentiometer. The sensing element had a spectral response with maximal sensitivity at 4000-4900 Angstrom units. Discussed in some detail are data, for thirteen dates, on light penetration at depths of 1-4.3 meters, the lowest limit of rooted vegetation. Dates were chosen for their biological significance, for example, dates of maximum clarity, diatom maxima, and cyanophyte maxima. Analysis of the data led to conclusion that penetration of light in Windermere depends chiefly on the number of phytoplankters in the epilimnion. Greatest depth at which rooted hydrophytes can grow must therefore be affected by phytoplankton abundance. Hydrophytes grow fastest in July and August, when presence of cyanophytes allows penetration to 4.3 meters of only 1.5-2.5% surface intensities, as compared with 6.7% at maximum clarity and 4-5% at average clarity. On 12 June, a typical date at which the diatom pulse is uniformly mixed throughout the epilimnion, penetration to 4.3 meters was 1.5% of surface illumination. (Eichhorn-Wis)
W69-04020

SECULAR CHANGES IN THE TRANSPARENCY OF LAKE WATERS,
College of Literature and Science, Tokyo (Japan). Geographical Inst.
Shinkichi Yoshimura.
Proc Imperial Acad Japan, Vol 9, No 9, pp 502-505, 1933. 3 tab, 1 ref.

Descriptors: *Lakes, *Light penetration, *Optical properties, *Color, Limnology, Eutrophication, Oligotrophy, Dystrophy, Succession.
Identifiers: *Transparency, *Secular changes, Japan, Anabaena planctonica, Lake Noziri, Lake Aoki, Lake Nakatuna, Lake Kizaki, Lake Haruna, Lake Inawasiro, Acidotrophy, Mesotrophy.

Optical properties of lake water offer convenient rough evidence of trophic status and productivity. Color and transparency relate to lake type thus: blue and transparent water indicates oligotrophy; green-yellow water of reduced transparency, eutrophy; less transparent brown water, dystrophy. Author records available data for minimal transparencies (depth of disappearance of white disc, 25-30 centimeters diameter) for six Japanese lakes. Color determination techniques are not described. Between 1907 and 1933, transparency ranges for four mountain lakes (N = number of observations) were: oligotrophic Noziri, 7.0-10.8 meters (N=17); oligotrophic Aoki, 5.6-13.8 meters (N=12), oligotrophic Nakatuna, 3.0-7.0 meters (N=12), mesotrophic Kizaki, 5.0-7.9 meters (N=15). Lack of secular trends in data supports hypothesis that little eutrophication occurred here, notwithstanding substantial cultural development along shores during last 15 years of period. In 1906, transparency (N=6) of caldera Lake Haruna decreased from 9.5 to 1.3 meters and color (N=2) increased, evidencing eutrophy. This was substantiated in 1929 by sudden appearance of Anabaena. Volcanic eruption (1902) made caldera Lake Inawasiro acidotrophic and turbid. By 1930, increase in transparency (N=7) from 14.0 to 27.5 meters and decrease in color (N=4) indicated return to oligotrophy. (Eichhorn-Wis)
W69-04022

NITROGEN FIXATION IN TWO WISCONSIN LAKES,
Wisconsin Univ., Madison. Dept. of Zoology.
John J. Goering, and John C. Neess.
Limnol Oceanogr, Vol 9, pp 530-539, 1964. 5 fig, 6 tab, 23 ref.

Descriptors: *Wisconsin, *Lakes, *Nitrogen fixation, Nitrate, Ammonium, Rates, Limnology, Eutrophication.

Rates of biological nitrogen fixation in two Wisconsin lakes are given. Fixation occurs at moderate rates throughout the ice-free season in Lake Wingra. In Lake Mendota the rate is normally zero throughout the ice-free season, but occasional, sometimes high, rates are observed. Glucose had no consistent effect on nitrogen fixation in the dark and appeared to inhibit fixation in the light. The effects of added ammonia and nitrates, as well as incubation time, were inconsistent. The maximum rate of nitrogen fixation was obtained with a light intensity of 3750 lux. Within the temperature range 16 to 30 deg C, fixation increased at a constant rate. (Konrad-Wis)
W69-04026

AXENIC CULTURE AND NUTRITIONAL STUDIES OF AQUATIC MACROPHYTES,
Michigan State Univ., Hickory Corners. W. K. Kellogg Biological Station.
Robert G. Wetzel, and Don L. McGregor.
Amer Midland Naturalist, Vol 80, No 1, pp 52-64, July 1968. 3 fig, 8 tab, 21 ref.

Descriptors: *Cultures, *Nutrient requirements, *Aquatic plants, Algae, Bicarbonates, Organic compounds, Calcium, Chara, Chlorophyll, Eutrophication, Growth stages, Invertebrates, Iron, Lakes, Light, Magnesium, Oxidation-reduction potential, Oligotrophy, Phosphates, Photosynthesis, Plant growth regulators, Pondweeds, Potassium, Sodium, Vitamin B.
Identifiers: *Axenic culture, Macrophytes, Marl lakes, Cations, Naja flexius, Amnicola lustrica, Amnicola limosa, Candona inopinata, Darwinula stevensoni, Angiosperms, Potamogeton, Chemo-organotrophic growth, Heterotrophy, Terazolium, Thin-layer chromatography, Gibberellic acid, Indole-3-acetic acid, Cyanocobalamin, Biotin, Thiamine, Osmoregultion.

Author studied growth and nutrition of Najas, Potamogeton and Chara in cultures resulting from sterilization of propagules with alcohol and/or hypochlorite. Low light intensities decreased and mild heat treatment without light increased percentage germination of Najas. Low light intensities (visible spectral range) provided more favorable conditions for germination of Chara. Najas germinated as well in aerated liquid media as in agar of low redox gradient. Cationic concentrations of media insignificantly affected germination of Najas and Chara. Brief treatment with indole-3-acetic acid (1000 mg/liter) and gibberellic acid (100 mg/liter) reduced germination markedly. Enhanced growth of Chara in cultures incorporating invertebrate feces evidenced chemo-organotrophic growth. Radioassay of carbon dioxide from van Slyke combustion of plants after uptake of labelled bicarbonate permitted estimation of photosynthetic rates. Photosynthesis decreased in Najas cultured in media with concentrations of divalent calcium ion greater than 20 mg/liter or with ratios of monovalent:divalent cationic concentrations less than one. Such conditions are consonant with those of environments of parent marl lakes. Of water-soluble vitamins, only cyanocobalamin (B-12) stimulated photosynthesis in Najas, a response similar to that observed from phytoplankters of marl lakes. (Eichhorn-Wis)
W69-04027

THE TAXONOMY AND ECOLOGY OF LEECHES (HIRUDINEA) OF LAKE MENDOTA, WISCONSIN,
Skopeje Univ. (Yugoslavia).
J. A. Sapkarev.
Wis Acad Sci, Arts Lett, Trans, Vol 56, pp 225-253, 1967-68. 18 fig, 3 tab, 39 ref.

Descriptors: *Wisconsin, *Ecological distribution, *Systematics, Ecology, Invertebrates, Lakes, Limnology, Animal parasites, Eutrophication, Bioindicators, Biomass.
Identifiers: *Lake Mendota (Wis), *Leeches, Population density, Piscicola, Glossiphonia, Batracobdella, Helobdella stagnalis, Placobdella, Dina, Erpobdella, Nephelopsis, Haemopsis.

Systematic monthly sampling of a single transect during September 1964-August 1965 and a sampling of 10 other transects (May 1965) of eutrophic Lake Mendota, Wisconsin, revealed that its leech fauna consist of 16 species in seven genera and three families. An additional family, genus, and species had been reported in the literature. Based upon total numbers encountered during sampling, dominant species was Helobdella stagnalis (dominance, 75.58%). Ranked according to dominance (ranges indicated), remaining species were: Glossiphonia complanata, Erpobdella punctata, Nephelopsis obscura, Dina parva (7.66-1.01%); G heteroclita, Helobdella elongata, Haemopsis marmorata, Batracobdella phalera (0.94-0.36%); Placobdella ornata, Helobdella lineata (0.10%); Placobdella sp (0.02% P parasitica, P montifera, B picta, Helobdella punctata-lineata (0.01%). Most eurytopic form, Helobdella stagnalis, occurred on widest variety of bottom types; in littoral, sublittoral, and rim of profundal zones; at depths from shoreline to 11 meters. Number of species limited to shallower areas bounded by isobaths indicated are: five in 0.5 meter; three in 1 meter; three in 2 meters; and one each in 3, 3.5, 4, 4.5, and 11 meters. Peak leech populations occurred in July when dominant species' young entered the population. (Eichhorn-Wisc)
W69-04028

2I. Water in Plants

RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
Forest Service (USDA) Wenatchee, Wash. Pacific Northwest Forest and Range Experiment Station.
H. W. Berndt, and W. B. Fowler.
J. Forest. 1969, 67 (2): 92-95, illus.

Descriptors: *Rime, *Frost, *Interception, *Water equivalent, *Winter, *Mountain forests, Air temperature, Saturation, Dew, Dewpoint, Water balance, Biomass.
Identifiers: *Horizontal interception.

Horizontally intercepted moisure--rime and hoarfrost--was studied in a lodgepole pine stand. Results show that this generally unmeasured supplemental precipitation amounts to 0.05 to 0.06 inch of moisture equivalent per day during periods of accumulation and could contribute as much as 3 to 4 inches total moisture in an entire winter.
W69-03807

NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4: EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
Cunningham Lab., Brisbane (Australia).
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03877

FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
Agricultural Research Service, Bozeman, Mont.; and Agricultural Research Service, Huntley, Mont.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03878

THE GREAT INDIAN DESERT. PERSPECTIVES IN THE ECOLOGY AND PHYSIOLOGY OF SMALL DESERT MAMMALS,
Western Australia Univ., Nedlands (Australia). Dept. of Zoology.

K. G. Purohit.
Mammalia, Vol 31, No 1, pp 28-49, 1967. 22 p, 8 tab.

Descriptors: *Mammals, *Deserts, *Ecology, Rodents, Water balance, Water requirements, *Animal physiology, Arid climates, *Animal metabolism, Thermal stress, Habitats, Food habits, Breeding, Urine, Microenvironment, Moisture stress, Nocturnal.
Identifiers: *Indian Desert, Thermoregulation, Renal function, Water deprivation, *Gerbils, Rajasthan (India).

Meteorological and biological characteristics of the Great Indian Desert place it in the category of the hot deserts under the Thornewaite classification of climate. The results of studies on the ecology, reproduction, thermoregulation, water metabolism and kidney function of small mammals and especially Meriones hurrianae, a rodent very resistant to the deprivation of water and food were explained and discussed. Small mammals do not use water for thermoregulation, the absence of sweat in most mammals may be seen as an adaption for water economy. Meriones hurrianae does not store an excess of water but fulfills its water requirements by economically spending water available in food and metabolic water. (Affleck-Arizona)
W69-03889

TREE-RING ANALYSIS: A TOOL FOR WATER RESOURCES RESEARCH,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03963

A MICROPSYCHROMETER TO MEASURE WATER POTENTIALS OF INTACT PLANT MATERIAL,
Nottingham Univ. (England). Dept. of Horticulture.
Man Singh Manohar.
Science and Culture, Vol 33, No 3, pp 134-136, March 1967. 2 fig.

Descriptors: *Hygrometry, *Germination, *Seeds, *Instrumentation, *Measurement, Osmosis, Plant physiology.
Identifiers: *Water potential, *Pea, Thermocouple, Psychrometers, Micropsychrometer.

The thermocouple psychrometer was modified to overcome its limitations with respect to pea seeds. Water potentials of a germinating pea seed and the germination medium were measured. Increase in water potential of an imbibing seed was expected but the slight decrease in water potential just after radicle emergence is as yet unexplained. No change in water potential of the germination medium was registered and pea seeds therefore do not appear to exude appreciable quantities of osmotically active materials during germination. The psychrometer could be used to measure water potential of seeds that are planted in arid regions of the world. (Blecker-Ariz)
W69-04109

EFFECTS OF EXTERNAL SALT CONCENTRATIONS ON WATER RELATIONS IN PLANTS: I. ABSENCE OF OSMOTIC ADJUSTMENT IN THE ROOT XYLEM,
California Univ., Riverside. Citrus Experiment Station.
J. J. Oertli.
Soil Science, Vol 102, No 3, pp 180-186, September 1966. 3 fig, 10 ref.

Descriptors: *Osmotic pressure, *Kinetics, *Salts, *Root systems, *Xylem, Saline soils, Salinity, Transpiration, Moisture deficit, Plant physiology, Equations, Flow rates, Solutes, Leaves, Model studies, Absorption.
Identifiers: Water transport.

A model of salt and water passage into and across plants was proposed. It involved a barrier in roots, mass flow in the xylem and another barrier around leaf vacuoles. These barriers were crossed by water and by solutes at different rates. It was shown that for various reasonable rate laws for salt and water transport, an osmotic adjustment within the xylem was not possible under saline conditions and under conditions of high transpiration. Under conditions of low transpiration and relatively low external salt concentrations, the same kinetics predicted the development and concentration dependence of root pressure. Soil salinity is a major area of concern since vast areas of arid lands are affected by this soil condition. (Blecker-Ariz)
W69-04113

SOIL-SALINITY CHANGES WITH FALLOW AND A STRAW MULCH ON FALLOW,
Agricultural Research Service, Grand Forks, N. Dak.; and Argicultural Research Service, Mandan, N. Dak.
L. C. Benz, F. M. Sandoval, and W. O. Willis.
Soil Science, Vol 104, No 1, pp 63-68, July 1967. 4 fig, 1 tab.

Descriptors: *Saline soils, *Fallowing, *Water table, *Mulching, Land reclamation, Crop production, Moisture content, Soil water, Soil properties, Sampling, Salt tolerance.
Identifiers: *Straw.

The purpose of this study was to determine effects of fallow and applied straw mulch on soil salinity in a water-table area and their possible utilization as a reclamation practice. Under the straw treatment, soil salinity decreased progressively during the three years to a depth of 91 cm. Salinity increases may have resulted from below normal rainfall or possibly noncultivation. Results showed that on bare fallow a soil mulch should be maintained to induce any reduction in soil salinity. Under straw mulch a singificant reduction in salinity was accomplished that allowed the growing of less salt-tolerant crops on the treated areas. The use of a straw mulch on saline soil could be another possible way of correcting a soil condition that is common to arid soils. (Blecker-Ariz)
W69-04116

GERMINATION OF WINTERFAT SEEDS UNDER DIFFERENT MOISTURE STRESSES AND TEMPERATURES,
Forest Service (USDA), Albuquerque, N. Mex. Rocky Mountain Forest and Range Experiment Station.
H. W. Springfield.
Journal of Range Management, Vol 21, No 5, pp 314-316, September 1968. 1 fig, 2 tab, 10 ref.

Descriptors: *Germination, *Moisture stress, *Temperature, *Seeds, Soil moisture, New Mexico, Water requirements, Drying.
Identifiers: *Winterfat seeds.

The report summarized results of a study of effects of six levels of moisture stress (0.0, 0.3, 3.0, 11.0, and 15.0 atmospheres) at five temperatures (86, 78, 53, 43, 37 degrees F) ON GERMINATION OF TWO SOURCES OF WINTERFAT SEEDS. Objectives were to determine whether: (1) winterfat seeds would germinate under the higher moisture stresses, (2) temperatures influenced germination responses and (3) responses to moisture stress and temperature varied with the source of the seed. As moisture stress increased, germination generally was reduced, regardless of temperature. Germination of both seed sources was less at alternating temperatures of 86-68 F than at the other temperatures. Data suggested that soil moisture approaching field capacity was necessary for appreciable germination of winterfat during the summer when temperatures were in the 80-100 F range in arid New Mexico. (Blecker-Ariz)
W69-04129

2J. Erosion and Sedimentation

HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXISO, 1951-60,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 04D.
For abstract, see .
W69-03747

THE MOVEMENT OF BEACH SAND,
University of Southern California, Los Angeles. Dept. of Geology.
James C. Ingle, Jr.
Amsterdam, Elsevier Publ Co, Develop Sedimentology 5, 1966. 221 p, 116 fig, 5 tab, 214 ref, 4 append.

Descriptors: *Beaches, *Sands, *Sediment transport, *Tracers, *Marking techniques, Dye releases, Littoral drift, Erosion, Movement, Provenance, Sediment control, Sediment load, Aquatic drift, Currents (Water), Marine geology, Ocean waves.
Identifiers: Dyed sand, Sand tracing, Beach studies.

A large-scale investigation of beach and sand movement was made using fluorescent-dyed sand releases as sediment-drift tracers. The techniques and results of a 2-year study along the southern California coastline are reported. Dyed sand was released once a month in the surf zones of 5 beaches and the sand dispersion was mapped. Movement is described in terms of wave and current parameters, bottom configuration, and surf conditions. Offshore movement in rip currents is described. Movement of different sized particles was traced by the use of different hues of dye. The effect of sand control works and other man-made obstructions on beaches was studied. (Knapp-USGS)
W69-03754

INFLUENCE OF VARIOUS RANGELAND CULTURAL TREATMENTS ON RUNOFF AND SEDIMENT PRODUCTION FROM THE BIG SAGE TYPE, EASTGATE BASIN, NEVADA,
Nevada Univ., Reno. Renewable Resource Center.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03873

RATES OF SLOPE DEGRADATION AS DETERMINED FROM BOTANICAL EVIDENCE, WHITE MOUNTAINS, CALIFORNIA,
Geological Survey, Washington, D. C.
Valmore C. LaMarche, Jr.
Geol Surv Prof Pap No 352-I, pp 341-377, 1968. 37 p, 36 fig, 2 plate, 8 tab, 39 ref.

Descriptors: *Erosion, *Mountains, *Measurement, *Bristlecone pine trees, California, Weathering, Degradation (Stream), Trees.
Identifiers: White Mountains (Cal).

Methods of calculating long-term rates of slope degradation were developed by studying the exposure of roots and ages of ancient bristlecone pines in dolomite areas in the semi-arid White Mountains of east-central California. The Precambrian Reed Dolomite underlies parts of a fluvially eroded terrane of high local relief. A subalpine bristlecone-pine forest covers dolomite areas between altitudes of 9,500-11,500 ft. A few living trees are known to be more than 4,000 yr old, but the average age of trees studied is about 1,000 yr. Age determinations were made by counting annual growth rings. There are uncertainties in some assigned ages due to incomplete growth records. Exposed tree roots are direct evidence of degradation. Local degradational rates are estimated from tree or root age and depth of root exposure. Data from 76 bristlecone pines at scattered points whithin a 20-sq mi area

suggest that degradational rates vary from less than 0.5 ft per 1,000 yr on the gentle lower slopes of high ridges to perhaps 4 ft per 1,000 yr along the adjacent steep banks of channels incised into alluvial fill. Degradational rates in crestal areas are high and apparently increase with slope, whereas those of the main valley side slopes are lower and are not closely related to slope angle. A rocky knoll has been degraded at about 1.2 ft per 1,000 yr during the past 2,700 yr, whereas the rate on a long valley side slope has been only about 0.8 ft per 1,000 yr in the same period. These rates of degradation are similar to denudational rates that have been estimated for comparable areas in other regions. (Knapp-USGS)
W69-03943

ON THE MAINTENANCE OF ANOMALOUS FLUID PRESSURES: 1. THICK SEDIMENTARY SEQUENCES,
Geological Survey, Washington, D. C.
J. D. Bredehoeft, and B. B. Hanshaw.
Geol Soc Amer Bull, Vol 79, pp 1097-1106, Sept 1968. 10 p, 6 fig, 2 tab, 25 ref.

Descriptors: *High pressure, *Connate water, *Hydraulic conductivity, *Porous media, *Unsteady flow, Filters, Pore pressure, Sedimentation, Gulf coastal plain.
Identifiers: Anomalous pore pressure, Lithostatic pressure.

Various physical and chemical processes may be envisioned which will cause anomalous pressures on an underground fluid. In order to consider the maintenance of anomalous pressure, it is necessary to consider the problem as one of nonsteady fluid flow. The time rate of pressure change and maintenance depends upon the hydrodynamics of flow through porous media and the particular boundary conditions. This paper presents a series of general solutions to hydrodynamic models which are germane to the problem of creating and maintaining excess-fluid pressures in a thick sedimentary sequence. The creation and maintenance of fluid pressures approaching lithostatic pressure through a process of continuous sedimentation was evaluated. Our results indicate that a sedimentation rate of 500 m/ million yr (reasonable for the Gulf Coast) will create fluid pressures approaching lithostatic in a sedimentary column that has a hydraulic conductivity of 0.00000001 cm per sec, or lower. It is apparent that the creation of anomalous pressure and its maintenance depends, to a large degree, upon the hydraulic conductivity and, to a lesser extent, upon the specific storage of clay layers with the system. (USGS)
W69-03954

CHERT AND ITS SODIUM-SILICATE PRECURSORS IN SODIUM-CARBONATE LAKES OF EAST AFRICA,
California Univ., Berkeley. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 02H.
For abstract, see .
W69-03955

RIVER ADJUSTMENT TO ALTERED HYDROLOGIC REGIMEN-MURRUMBIDGEE RIVER AND PALEOCHANNELS, AUSTRALIA,
Geological Survey, Washington, D. C.
S. A. Schumm.
Geol Surv Prof Pap 598, 1968. 65 p, 36 fig, 1 plate, 7 tab, 96 ref.

Descriptors: *Sedimentation, *Alluvial channels, *Paleohydrology, *Streams, *Channel morphology, Sediment transport, Geomorphology, Sediment yield, Discharge (Water), Regime, Shape, Slopes, Width, Meanders.
Identifiers: Murrumbidgee River (Australia), Paleochannels.

The Murrumbidgee River which flows westward across the Riverine Plain of New South Wales, Australia, is sinuous, narrow, and deep and transports relatively small quantities of sediment. On the flood plain of the modern river and on the surface of the Riverine Plain are traces of old aggraded and abandoned river channels or paleochannels. The ancestral-river channels resemble the channel of the modern river, but they are much larger. In contrast, the older prior-stream channels are relatively straight, wide, and shallow and are filled with cross-bedded sands. The differences can be attributed to the effects of Quaternary climate changes on the hydrologic regimen of the drainage basin. The prior streams moved large quantities of sand and were undoubtedly characterized by high flood peaks, but their runoff was probably less than that at present. The ancestral-river channels carried higher peak discharges and higher annual runoff than either the modern or prior-stream channels. Empirical equations were developed for stable alluvial rivers which demonstrate the influence of both discharge and type of sediment load on channel morphology. The induced changes may be difficult to recognize in a short span of time, but they will be significant over very long reaches of alluvial rivers, especially in arid to subhumid climatic regions. If possible, an adjustment of river gradient will be made by an increase or decrease of sinuosity. Deep incision of alluvial deposits in major river valleys may occur only as a result of diastrophism or of lowering of base level. Abrupt changes in sediment type in the stratigraphic record can reflect not only climatic and tectonic changes but also major river adjustments to these changes. (Knapp-USGS)
W69-03957

AGE AND COMPARATIVE DEVELOPMENT OF DESERT SOILS AT THE GARDNER SPRING RADIOCARBON SITE, NEW MEXICO,
Soil Conservation Service, University Park, N. Mex.
L. H. Gile, and J. W. Hawley.
Soil Sci. Soc. Amer. Proc., Vol 32, No 5, pp 709-716, Sept-Oct 1968. 4 tab, 6 fig.

Descriptors: *New Mexico, *Paleosols, *Sierozems, *Carbon radioisotopes, *Age, Arid lands, Erosion, Dating, Pleistocene epoch, Recent epoch, Soil formation, Paleoclimatology, Climatology, Alluvium, Calcareous soils, Soil horizons, Sediments, Topography.
Identifiers: *Charcoal horizons, Charcoal.

Radiocarbon ages have been obtained from seven charcoal horizons in a southern New Mexico arid region. Recent age highly calcareous alluvium deposits ranged from 1,100 to over 5,000 years. Pleistocene soils much older than 5,000 years occurred. Recent Pleistocene soils indicated present climate to be warmer and drier than Pleistocene pluvial climates. This could have decreased vegetative cover and caused erosion. Maximum and minimum ages for several soils formed in the deposits were established with the dated charcoal. Soil development of increasing age in Recent time was characterized by development of an A horizon, destruction of thin sedimentary strata, slight accumulation of carbonate, development of structure in materials of sufficiently fine texture and with continued carbonate accumulation, development of a weak calcic horizon. Pleistocene age soils could have distinct argillic horizons and strong horizons of carbonate accumulation. (Affleck-Ariz)
W69-04126

2K. Chemical Processes

MINERAL-WATER INTERACTION DURING THE CHEMICAL WEATHERING OF SILICATES,
Johns Hopkins Univ., Baltimore, Md. Dept. of Geography; Johns Hopkins Univ., Baltimore, Md. Dept. of Geology; and Maryland Geological Survey, Baltimore.
Owen P. Bricker, Andrew E. Godfrey, and Emery T. Cleaves.
Grant 665-G2 ACS, Grant GP 2660 NSF. Symp of Trace Inorg in Water, Advance in Chem Ser, No 73, pp 128-142, 1968. 15 p, 7 fig, 5 tab, 11 ref.

Descriptors: *Water chemistry, *Runoff, *Leaching, Infiltration, Silicates, Clays, Silica, Bicarbonates, Sodium, Magnesium, Calcium, Potassium, Maryland, Kaolinite.
Identifiers: Chemical weathering, Mineral-water interactions.

The geochemical balance of a 103 acre watershed underlain by silicate bedrock was investigated. Base flow composition of the stream water was essentially constant, but flood flows showed a decrease in concentration of silica, bicarbonate, and sodium and an increase in sulfate, magnesium, calcium, and potassium. Laboratory experiments indicate that fresh rock or soil reacts rapidly with distilled water and achieves a composition similar to the stream water, suggesting control of water composition by reaction with the silicate minerals. The alumino-silicate minerals react with carbon dioxide charged water to form kaolinite, releasing cations and silica to solution. The products of weathering are removed as particulate matter (0.28 metric tons/yr) and dissolved material (1.5 metric tons/yr).
W69-03724

THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
Naval Oceanographic Office, Washington, D. C.; and Massachusetts Inst. of Tech., Cambridge.
Neil R. Anderson, and David N. Hume.
Symp on Trace Inorg in Water, Advance in Chem Ser, No 73, pp 296-307, 1968. 12 p, 6 tab, 24 ref. AT (30-1)-2174, AT (30-1)-3145, AT (30-1)-905, Grant NSF-G12178.

Descriptors: *Trace elements, *Sea water, *Chemical analysis, Ion exchange, Flame photometry, Chlorides.
Identifiers: Strontium, Barium, Book.

Concentrations of strontium and barium in sea water were simultaneously determined by a combination of ion exchange concentration and flame photometry to ascertain more precisely strontium/chlorinity and barium/chlorinity ratios and to investigate the magnitude and nature of the strontium/chlorinity ratio variation if it was found. The results of the analyses of several ocean stations presented indicate that there is about 3%, but statistically significant, variation in the strontium/chlorinity ratio with respect to depth in sea water. An indication of a possible variation in the absolute amounts of strontium in sea water with the geographical location has also been observed. The barium/chlorinity ratio variation with respect to depth was found to be about 90% larger than that of strontium.
W69-03726

NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
Central Inst. for Industrial Research, Oslo (Norway); and Woods Hole Oceanographic Institution, Mass.
Ove T. Hogdahl, Sigurd Melsom, and Vaughan T. Bowen.
Symp on Trace Inorg in Water, Advance in Chem Ser, No 73, pp 308-325, 1968. 19 p, 6 fig, 7 tab, 14 ref. AT (30-1)-2174, AT (30-1)-1918, Grant NSF-GP-5319.

Descriptors: *Trace elements, *Sea water, Distribution patterns, Chemical analysis, Neutron activation analysis, Regression analysis, Elements (Chemical).
Identifiers: Lanthanide elements.

Neutron activation analyses of 16 samples of sea water (8 in duplicate) taken at 6 widely spaced stations in the Central Atlantic Ocean between 16 deg N and Equator at depths below 1000 m showed that the lanthanide patterns are relatively conservative characteristics of water masses. The differences in lanthanide distribution and total abundance between different water masses are small but significant. The absolute mass abundances of the lanthanides can be illustrated by

the following values for North Atlantic Deep Water: La, 0.0034 microgram/liter; Nd, 0.0028 microgram/liter; Gd, 0.00070 microgram/liter; Ho, 0.00022 microgram/liter; Yb, 0.00082 microgram/liter; Ce, 0.0012 microgram/litter; Sm, 0.00045 microgram/liter; Tb, 0.00014 microgram/liter; Er, 0.00087 microgram/liter; Lu, 0.00015 microgram/liter; Pr, 0.00064 microgram/liter; Eu, 0.00013 microgram/liter; Dy, 0.00091 microgram/liter; Tm, 0.00017 microgram/liter; Y, 0.0133 microgram/liter. (Samples were taken during the Atlantis II cruise.)
W69-03727

ALUMINUM SPECIES IN WATER,
Geological Survey, Menlo Park, Calif.
John D. Hem.
Symp on Trace Inorg in Water, Advance in Chem Ser, No 73, pp 98-114, 1968. 17 p, 13 fig, 1 tab, 16 ref.

Descriptors: *Aqueous solutions, *Aluminum, Water chemistry, Thermodynamics, Water properties, Kinetics, Microscopy.
Identifiers: Bayerite, Gibbsite, Aluminum polymers, Book.

Polymeric species of aluminum and hydroxide formed in 0.01M NaC10 sub 4 solutions, 10 esp - 3.34 M in aluminum, after adding sufficient OH to reach pH 4.75 - 6.50 were identified by electron microscopy as gibbsite. The particles had diameters near 0.10 micron after 10 days of aging, when the molar ratio of bound OH/total Al (r) was between 2.0 and 3.0. The amount of OH in bridging positions in the polymer structure was determined by the kinetics of dissolution of the polymer in acid. When r exceeded 3 the precipitate formed was bayerite. Standard free energy values determined, in kcal per mole, include: AlOH ion, -165.2; Al (OH) sub 4 ion, -311.7; Al (OH) sub 3 (microcrystalline gibbsite), -272.3; Al (OH) sub 3 (bayerite), -274.0. Many natural waters contain enough fluoride that predominant aluminum solutes are fluoride complexes. (Knapp-USGS)
W69-03728

SODIUM-TO-CHLORINE RATIO IN HAWAIIAN RAINS AS A FUNCTION OF DISTANCE INLAND AND OF ELEVATION,
Hawaii Univ., Honolulu. Dept. of Chemistry; and Hawaii Institute of Geophysics, Honolulu.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-03735

DETERMINATION OF STRONTIUM-90 IN WATER,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 05A.
For abstract, see .
W69-03749

MINERAL SPRINGS OF THE DAYLESFORD DISTRICT,
Melbourne Univ., Parkville (Australia). Dept. of Geology.
R. J. W. McLaughlin, and Jennifer J. Macumber.
Proc Roy Soc of Victoria, Vol 81, Part 2, pp 143-148, Sept 27, 1968. 6 p, 2 fig, 2 tab, 22 ref.

Descriptors: *Water quality, *Spring waters, *Mineral water, Salts, Thermal water, Chemical analysis, Percolating water, Meteoric water.
Identifiers: Australia, Daylesford.

Mineral springs in the Daylesford region, Australia, were analyzed for Na, K, Li, Ca, Mg, Fe, Mn, B, carbonate, silica, phosphate, Cl, and Br. The ratios of the major cations are similar to those of normal surface waters, and silica and boron are low, indicating an origin from percolating meteoric waters with no contribution from nearby volcanic fumaroles despite close association with basalt. (Knapp-USGS)
W69-03933

OCCURRENCE OF SELECTED MINOR ELEMENTS IN THE WATERS OF CALIFORNIA,
Geological Survey, Washington, D. C.
William D. Silvey.
Geol Surv Water-Supply Pap 1535-L, pp L1-L25, 1967. 8 fig, 6 tab, 21 ref.

Descriptors: *Water treatment, *Water analysis, *Chemical precipitation, *Spectroscopy, California, Iron, Sea water, Streams, Springs, Wells.
Identifiers: *Pacific Ocean, *Minor element occurrence, Nickel, Vanadium.

Sea water, stream water, and deep-seated spring waters were studied for the occurrence of 17 minor elements. The occurrence of these elements was strongly influenced by the vertical position of the water relative to the Earth's surface, and occurrence and concentration are strongly affected by biota in the hydrologic environment. Where biologic activity is at a maximum, as in the case of sea water, the concentration and number of minor elements are at a minimum; the converse is also true. Well water and oil-field brine in an intermediate position between deep-seated water and stream water contain minor elements found in both deep-seated water and stream water. Iron, nickel, and vanadium most frequently occurred in the waters examined; beryllium was not found in any of the waters. (Llaverias-USGS)
W69-03966

HYDROCARBONS OF BLUE-GREEN ALGAE: GEOCHEMICAL SIGNIFICANCE,
Texas Univ., Port Aransas. Inst. of Marine Science.
Kenneth Winters, P. L. Parker, and Chase Van Baalen.
Science, Vol 163, No 3866, pp 467-468, 31 Jan 1969. 2 tab, 7 ref.

Descriptors: *Cyanophyta, *Geochemistry, Chromatography, Cultures, Analytical techniques, Gas chromatography, Estuaries, Saline water, Sediments.
Identifiers: *Hydrocarbons, Trichodesmium erythaeum, Coccochloris elabens, Microcoleus chthonoplastes, Nostoc muscorum, Agmenellum quadruplicatum, Plectonema terebrans, Oscillatoria williamsii, Lyngbya lagerhaimii, Anacystis nidulans, Intermediary metabolism, Monoenoic hydrocarbons, Dienoic hydrocarbons, Hypersaline environments.

Authors determined hydrocarbon composition of 11 species of cyanophytes derived from pure cultures and natural environments. Hydrocarbons were extracted with methanol and hexane, separated on silica gel columns, and identified from their retention times in the gas chromatograph. Compositions so determined are simple and qualitatively similar. The marine coccoids, Coccochloris elabens and Agmenellum quadruplicatum, contained only monoenoic (85-98%) and dienoic (2-13%) C-sub-19 compounds. Remaining species contain C-sub-15 to C-sub-18 hydrocarbons, with preponderance of saturated C-sub-17 compounds (36-95%). The fact that no C-sub-9 or C-sub-10 hydrocarbons were detected in Trichodesmium, a form whose fatty acids include 50% C-sub-10 saturated chains, suggests that fatty acids are not precursors of hydrocarbons. Compounds with molecular weights of C-sub-20 or higher were not detected. Although biological functions and restricted biosynthesis of hydrocarbons in the blue-green algae are not understood, it does appear that long chain hydrocarbons (20 carbon atoms and longer) found in ancient sediments are not derived from cyanophytes. (Eichhorn-Wis)
W69-04021

2L. Estuaries

STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
Federal Water Pollution Control Administration, Washington, D. C.; and Kansas City, Mo.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03732

IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
California State Dept. of Public Health, Berkeley.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03738

MICROBIOLOGY OF OCEANS AND ESTUARIES,
Miami Univ., Fla. Inst. of Marine Science.
E. J. F. Wood.
Amsterdam, Elsevier Publ Co Oceanogr Ser, 1967. 319 p, 29 fig, 8 plate, 19 tab, 521 ref.

Descriptors: *Microbiology, *Aquatic microbiology, *Estuaries, *Marine microorganisms, Marine algae, Marine animals, Marine bacteria, Marine fungi.
Identifiers: Estuarine microbiology.

A textbook on marine and estuarine microbiology is primarily intended for undergraduate students in marine biology and oceanography and may also be of use to research workers in marine microbiology. The problems usually encountered in study, including sampling techniques, taxonomy, and quantification, are discussed thoroughly. Environmental relationships and modifications by organisms of their environments are explained. Taxonomy is discussed with references to the most significant taxonomic works and workers in each group. Nutrition and reproduction are considered in detail. Economic aspects such as fouling, the relation of borers to fungi, microbial corrosion, fermentation, rotting of cordage and structures, fish spoilage, shellfish poisoning, and geobiological aspects and ore formation are discussed. (Knapp-USGS)
W69-03752

UNITED STATES V SMOOT SAND AND GRAVEL CORP (OWNER OF CONDEMNED RIPARIAN LANDS RIGHTS IN UNDERWATER GRAVEL DEPOSITS).
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03910

DETERMINATION OF NITRATE IN ESTUARINE WATERS AUTOMATIC DETERMINATION USING A BRUCINE METHOD,
Federal Water Pollution Control Administration, Metuchen, N. J.
Lloyd Kahn, and Francis T. Brezenski.
Environ Sci Technol. Vol 1, No 6, pp 492-494, June 1967. 2 fig, 2 tab, 9 ref.

Descriptors: *Nitrate determination, *Automation, *Estuaries, *Analytical techniques, Methodology.

An automated procedure for the determination of nitrates in estuarine and sea waters is presented. The method is adapted from the manual determination described by Kahn and Brezenski, and a two-fold increase in precision resulted from the automation. Samples containing from 0.05 to 0.6 mg of nitrate-nitrogen per liter were analyzed with a standard deviation of less than 0.01 mg of nitrate-nitrogen per liter. A flow diagram for use with the Technicon Auto Analyzer is provided. (Konrad-Wis)
W69-04025

DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-04133

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

THE STRONTIUM AND BARIUM CONTENT OF SEA WATER,
Naval Oceanographic Office, Washington, D. C.; and Massachusetts Inst. of Tech., Cambridge.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03726

NEUTRON ACTIVATION ANALYSIS OF LANTHANIDE ELEMENTS IN SEA WATER,
Central Inst. for Industrial Research, Oslo (Norway); and Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03727

ALUMINUM SPECIES IN WATER,
Geological Survey, Menlo Park, Calif.
For primary bibliographic entry see Field 02K.
For abstract, see .
W69-03728

SALINITY AND ARIDITY,
For primary bibliographic entry see Field 03C.
For abstract, see .
W69-03751

3B. Water Yield Improvement

EVAPORATION RETARDED BY MONOLAYERS,
Commonwealth Scientific and Industrial Research Organization, North Ryde (Australia). Wheat Research Unit.
F. MacRitchie.
Science, Vol 163, No 3870, pp 929-931, Feb 28, 1969. 3 p, 2 tab, 10 ref.

Descriptors: *Evaporation control, *Hexadecanol, Air-water interfaces, Vapor pressure, Adsorption, Diffusion, Convection, Surface tension, Thermal stress, Humidity.
Identifiers: *Monolayers, Surface pressure gradient, Vapor transport.

Reduction in the steady-state rate of water evaporation by hexadecanol monolayers is discussed and pertinent experiments are reviewed and correlated with work of various researchers. Retardation depends only on the air velocity above the surface and is independent of the absolute rate of evaporation up to air velocities of 40 cm per second. The hexadecanol monolayer exerts its effect by altering the hydrodynamic boundary conditions. It increases the size of the diffusion boundary layer. The highest air velocity in the experiments described was 480 cm/sec so that, at a value of 0.15 for the kinematic viscosity of air at 20 deg C, the highest Reynolds No. calculated is 29x10 to the 4th power. Laminar flow is assumed in all the experiments. Small surface pressure gradients can thus cause significant changes in boundary layer properties and consequently evaporation rates. (Lang-USGS)
W69-03722

A PROGRESS REPORT ON PROJECT SKYWATER THE BUREAU OF RECLAMATION'S ATMOSPHERIC WATER RESOURCES PROGRAM,
Bureau of Reclamation, Denver, Colo.
Archie M. Kahan.
Pap, Annu Meet Colo River Water Users Ass, Las Vegas, Nev, Dec 1968. 17 p, 4 fig.

Descriptors: *Weather modification, *Cloud seeding, Cloud physics, *Artificial precipitation, *Water resources development, Snowfall, Atmospheric precipitation, Research and development, Water resources, Precipitation (Atmospheric), Silver iodide, Planning, Instrumentation, Costs, Meteorological data.
Identifiers: *Atmospheric research, Bureau of Reclamation, Snowstorms, *Project Skywater, Silver iodide generators, Snow samplers.

This paper reports the present status of Project Skywater, the Bureau of Reclamation's Atmospheric Water Resources Program, discusses recent progress, and provides some details of the planned Colorado River Pilot Project. Thirty-seven research groups, with an annual total support level of $4,700,000, are engaged in studies designed to develop technology for precipitation management. Recent experimental evidence indicates that cloud seeding results can range from increases to decreases, depending on meteorological circumstances attendant to individual seedings. Mathematical models of cloud behavior are available to guide field experimentation. Instrumentation for tracing nuclei plumes is coming into widespread use. An operationally-oriented, randomized pilot project is being planned for the Upper Colorado River Basin. (USBR)
W69-03769

PROCEEDINGS: INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
National Science Foundation, Washington, D. C.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03806

RIME AND HOARFROST IN UPPER-SLOPE FORESTS OF EASTERN WASHINGTON,
Forest Service (USDA) Wenatchee, Wash. Pacific Northwest Forest and Range Experiment Station.
For primary bibliographic entry see Field 02I.
For abstract, see .
W69-03807

EVAPORATION OF WATER: ITS RETARDATION BY MONOLAYERS,
Columbia Univ., New York. Dept. of Mineral Technology; and Calif. Univ., Berkeley. Dept. of Mineral Technology.
Victor K. LaMer, and Thomas W. Healy.
Science, Vol 148, No 3666, pp 36-42, April 3, 1965. 7 p, 4 fig, 1 tab, 33 ref.

Descriptors: *Evaporation control, *Alcohols, *Monomolecular films, Reservoir evaporation, Retardants, Lakes, Molecular structure, Costs, Solvents, Thermal properties, Rates of application, Economic feasibility, *Water loss, *Resistance, Winds, On-site tests.
Identifiers: Hydrocarbon chain, Capillary waves.

Utilization of monolayers to reduce evaporation on lakes and reservoirs was outlined. Principles of using monolayers were examined with respect to the way in which water evaporates. Also considered were molecular architecture of the monolayer, mixed monolayers, impurities in short-chain alcohols, spreading solvents, capillary waves and the thermal history of monolayer materials. Practical aspects of using monolayers were discussed, using bodies of water where the alcohols were applied at different rates and under different climatic conditions. (Blecker-Arizona)
W69-03884

AUGMENTING COLORADO RIVER BY WEATHER MODIFICATION,
Bureau of Reclamation, Denver, Colo.
Patrick A. Hurley.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6271, pp 363-380, Dec 1968. 18 p, 7 fig, 2 tab, 19 ref.

Descriptors: *Weather modification, *Water supply, *Colorado River Basin, *Cost-benefit ratio, Meteorology, Runoff, Precipitation (Atmospheric), Research and development.

An overall perspective on the promising potential for increasing winter precipitation over mountains of the Upper Colorado River Basin is presented in an engineering context for water development planners. The resulting augmented spring runoff, regulated by existing reservoirs, can provide additional water to meet growing demands for the region where present water supplies are becoming critically short. Increasing the November through April precipitation by 15% over 14,200 sq mi of target areas generally located at elevations above 9500 ft will yield an average additional runoff of 1,870,000 acre-ft annually. This practical capability to enhance the winter snowfall should be developed by the mid-1970's through the outlined $25,000,000 applied research field program. Exclusive of initial research costs, regular production costs by weather modification are estimated at $1.00 to $1.50 an acre-ft for the new water. Average additional benefits are estimated to be $20,000,000 to $25,000,000 annually, for a highly favorable benefit-cost ratio of about 10 to 1.
W69-03950

INCREASING WATER YIELD IN THE NORTHEAST BY MANAGEMENT OF FORESTED WATERSHEDS,
Forest Service (USDA), Upper Darby, Pa. Northeastern Forest Experiment Station; and Forest Service (USDA), Parsons, W. Va. Northeastern Forest Experiment Station.
Howard W. Lull, and Kenneth G. Reinhart.
Forest Serv Res Pap NE-66, 1967. 45 p, 1 fig, 3 tab, 56 ref, 2 append.

Descriptors: *Watershed management, *Clear-cutting, *Herbicides, *Water yield improvement, Cutting management, Northeast U. S., Erosion control, Forest management, Land management, Watersheds (Basins), Weed control.
Identifiers: Experimental forests, Experimental watersheds.

Increasing water yield from forested watersheds by total or partial forest removal is discussed. Forest removal by cutting or herbicides is analyzed in terms of effectiveness, yield, and cost. Prevention of yield reduction by reforestation or by long-term policies of forest protection is also discussed. Precautions and safeguards necessary for production and maintenance of high-quality water from managed watersheds are listed. (Knapp-USGS)
W69-03980

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

WIND-TUNNEL INVESTIGATION OF AIR FLOW OVER A HEXADECANOL MONOLAYER SPREAD ON A WATER SURFACE,
Maryland Univ., College Park; and Oklahoma State Univ., Stillwater.
W. F. Schwiesow, and F. R. Crow.
Transactions of the ASAE, Vol 11, No 4, pp 553-557, July-Aug 1968. 11 fig, 2 tab.

Descriptors: *Monomolecular films, *Hexadecanol, *Tunnels, *Air circulation, *Winds, Air-water interfaces, Evaporation control, Regression analysis, Least squares method, Ponds, Reservoir evaporation, Equations, Barriers, Analytical techniques, Surfaces, Water loss, Variability.
Identifiers: Wind tunnel.

An investigation was conducted in the laboratory using a 4 by 4 by 50 ft wind tunnel to study the air flow over a small pond on which barriers were erected to prevent the loss of hexadecanol film due to wind. Experiments were conducted to determine hexadecanol film coverage on test reservoirs without barriers, with vertical barriers of varied height, with barriers having different amounts of open area, with low flat barriers and sloping barriers. A prediction equation was developed relating the length of hexadecanol film covering a water surface to the wind shear force that acts on the film. A multivariable regression analysis was used to evaluate film coverage when no barriers were present. Linear regression analysis was used to determine the several barrier influence relationships. (Affleck-Ariz)
W69-04125

3C. Use of Water of Impaired Quality

SALINITY AND ARIDITY,
H. Boyko.
The Hague, Dr. W. Junk Publ, 1966. 408 p, 37 fig, ref.

Descriptors: *Arid climates, *Arid lands, *Saline soils, *Salt tolerance, Salinity, Irrigation, Saline water systems, Dunes, Sands.
Identifiers: Saline water irrigation, Book.

New approaches to the problem of supplying irrigation water to arid and saline regions are surveyed with particular emphasis given to the use of saline water or seawater for irrigation. The methods and results of experiments on the effects on plants of using saline irrigation water in various countries are presented in articles covering local research. It is shown that the salt tolerance of most plants is highest in dune sand. Salt water of concentrations as high as sea water can be used to grow some crops in dune areas. Desalination techniques and the effects, causes, and remedies for soil salinization are discussed in detail. (Knapp-USGS)
W69-03751

MINERAL-WEATHERING CORRECTION FOR ESTIMATING THE SODIUM HAZARD OF IRRIGATION WATERS,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Rhoades.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 648-652, Sept-Oct 1968. 5 p, 2 fig, 2 tab, 10 ref.

Descriptors: *Sodium, Hazards, *Irrigation water, Water quality, Soil science, Water pollution, Mineralogy, Forecasting, Calcium, Carbonates, *Soil chemical properties, *Soil properties, Saline soils, Irrigation, Laboratory tests, Solutes, Drainage water, Minerals, Leaching, Calcareous soils, Lysimeters.
Identifiers: *Sodium adsorption ratio.

An equation for evaluating the sodium hazard of irrigation waters has been modified to include the effect of soil-mineral weathering on changes occurring in the SAR (sodium adsorption ratio) values of waters applied to soils. The modification involves incorporating a coefficient that reduces the predicted soil drainage-water SAR values by various amounts, depending on the mineral properties of the soil and the leaching regime used. The value of the coefficient required in the equation can be determined by simple laboratory procedures. The modified equation was tested on a calcareous soil by comparing SAR values predicted from the equation with values obtained in a controlled lysimeter experiment. The applicability of the equation is supported by the excellent correspondence obtained between calculated and observed SAR values. (USBR)
W69-03791

THE EFFECT OF SOIL-MINERAL WEATHERING ON THE SODIUM HAZARD OF IRRIGATION WATERS,
Agricultural Research Service, Riverside, Calif. Salinity Lab.
J. D. Rhoades, D. B. Krueger, and M. J. Reed.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 643-647, Sept-Oct 1968. 5 p, 1 fig, 7 tab, 10 ref.

Descriptors: Water quality, Water pollution, Arid lands, Soils, Salts, Minerals, *Sodium, Hazards, *Irrigation water, Cation exchange, Calcium, *Weathering, Mineralogy, Effluents, Magnesium, Soil science, Solutes, *Soil chemical properties, Saline soils, Permeameters, Laboratory tests, *Soil properties.
Identifiers: *Sodium adsorption ratio.

The extent to which the release of solutes from soil-mineral weathering processes changes the composition of applied irrigation waters was evaluated for 6 arid-land soils. Soil samples were packed in plexiglas permeameters and pretreated to: (1) remove readily soluble organic matter, (2) minimize subsequent microbial activity, and (3) equilibrate soil exchange complexes with irrigation waters. Soil solutions were displaced from the nearly saturated columns and analyzed at biweekly intervals until a steady composition was attained. Effluent solutions were 3-5 milliequivalents/liter higher in total salt content than the applied waters. Gains were accounted for primarily by Ca plus Mg and hydrogen carbonate ions. The net effect of these changes in solution compositions was a 30-90% reduction in SAR (sodium adsorption ratio) values of applied solutions. SAR reductions were greatest for waters of lower salt concentrations, but were significant even for waters containing as much as 15-20 meq of salt per liter. This phenomenon reduces the Na hazard expected with certain irrigation waters, and should be considered in water quality evaluation.
W69-03792

TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
Hebrew Univ., Jerusalem (Israel).
Dan Yaron.
For 8-Volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 6, pp 749-756, 1968. 12 p, fig, 1 tab, 13 ref.

Descriptors: *Irrigation water, *Water quality control, Salt balance, Statistical methods, *Water supply, *Water demand.
Identifiers: *Saline water systems, Evaluation.

Water quality is controllable. Therefore, the quantity and quality of water should be considered as economically meaningful parameters in water resource development or management decisions. The effects of irrigation with saline water on crop yields are reviewed. Next, a highly simplified economic model, which optimizes possible quantity - quality combinations within a framework of the supply and demand for irrigation water, is presented. In making this model more realistic, the supply side is treated only indirectly but the distinction is explicitly made between the supply and demand. The major portion of this paper deals with the evaluation of the quality of water in irrigation. (Grossman-Rutgers)
W69-04059

3D. Conservation in Domestic and Municipal Use

PUBLIC UTILITIES - LIGHT AND WATER SUPPLY.

N J Stat Ann secs 40:62-88, 40:62-89 (1967).

Descriptors: *New Jersey, *Hydroelectric power, *Public benefits, *Pumping plants, Legislation, Lighting, Power plants, Condemnation, Construction, Water supply, Pumps, Water storage, Streams, Rivers, Artesian wells, Water distribution, Local governments, Cities.

The body in charge of the public water supply in any municipality may use any property which has been used for the purpose of supplying water, or acquire additional property by purchase or condemnation, for the purpose of generating electrical energy to supply that municipality with light, or for other public use. That body may also acquire land for the purpose of furnishing water power to drive and operate pumping stations or other machinery used in storing water from streams, rivers and artesian sources and in distributing such water for use in the municipality. (Shevin-Fla)
W69-03856

WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-03971

KANE V VILLAGE OF RED HOOK (FIRE PROTECTION REQUIREMENTS DETERMINATIVE OF 'EXCESS WATER' OF SUPPLY CONTRACT).

10 A D 2d 960, 201 N Y S 2d 590-591 (1960).

Descriptors: *Surplus water, *Excess water (Legal aspects), *Supply contracts, *Supply, Water tanks, New York, Judicial decisions, Water storage, Water requirements, Water works, Water utilization, Legal aspects.
Identifiers: Fire protection (Water needs).

Plaintiff taxpayers brought suit to restrain the performance of a contract whereby the defendant village agreed to supply water from its system to homes outisde the village. The lower court held for the taxpayers, and the village appealed. This court affirmed with modifications. New York law provides that a village may only sell 'surplus water' for use outside the village, and the plaintiffs contended that the village must consider the needs of fire protection when determining whether there is 'surplus water'. The court found that the present supply would not deliver 1,000 gallons per minute to a fire for six hours even if no water was being used for other purposes. This being so, the lower court was correct in holding that the defendant had no surplus water. Two concurring judges would have allowed the village to maintain the contract provided its system could be modified so as to cut off or reduce the water supply to homes outside the village during a fire or other emergency within the village. (Blunt-Fla)
W69-04005

CITY OF COLD SPRING V CAMPBELL COUNTY WATER DISTRICT (RIGHT OF MUNICIPALITY TO SERVE CUSTOMERS OUTSIDE ITS CORPORATE LIMITS).

334 S W 2d 269-275 (Ct App Ky 1960).

Descriptors: Kentucky, Judicial decisions, *Administrative agencies, Permits, *Water districts, *Cities, Water distribution, Public utilities, *Boundary disputes, Water permits, Water supply, Water delivery, State jurisdiction, Water rates, Water works, Distribution systems, Legal aspects.

The water district brought this action to establish that it, and not the defendant municipality, had the exclusive right to provide water service in the area comprising the district. The city of Cold Spring had requested and gained the permission of the State Public Service Commission to construct lines to purchase additional water from the city of Covington. The controversy arose out of the city's supplying water to some 43 homes, located five miles beyond the city limits, which were along the path of

the new line. The water district has never served these people, and they had requested city water service. The city based its alleged right on the certificate from the Public Service Commission, while the district claimed exclusive rights within its territory. The city appealed a ruling in favor of the district; this court reversed with directions. The decision was based on a construction of a state statute hence, the court held that the question whether the district had exclusive privileges was a question of law for the court and not a question of fact for the Public Service Commission. Where a controversy is between persons or corporate bodies engaged in public utility enterprises the right to construct new facilities is based on facts to be determined by the commission in deciding which party shall be issued the certificate. Courts may decide whether statutes grant one party an exclusive privilege to the exclusion of another, but, failing to find such exclusive privilege, the controversy and its resolution are within the Commission's jurisdiction. (Blunt-Fla)
W69-04006

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

3E. Conservation in Industry

WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-03965

GEOLOGY AND GROUNDWATER OF THE SAVANNAH RIVER PLANT AND VICINITY, SOUTH CAROLINA,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03970

FISHERIES JURISDICTION BEYOND THE TERRITORIAL SEA - WITH SPECIAL REFERENCE TO THE POLICY OF THE UNITED STATES,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04046

DIRECTOR OF IRRIGATION.

Ala Code tit 8, sec 9 (1) (1967 Supp).

Descriptors: *Alabama, *Irrigation districts, *Administrative agencies, Legislation, Water conservation, Inter-agency cooperation.
Identifiers: *Director of irrigation.

There shall be established in the state department of conservation, the office of the director of irrigation. The director shall be appointed by the governor from a list of qualified nominees and shall serve a four year term at a salary of $12,000 per annum. The duties of the director shall be to work with and assist any irrigation district established or proposed. The director shall assist in formulating plans for establishing districts, shall supervise all work in connection therewith, and shall exercise general supervision whenever state interests or conflicts arise with respect to state programs of irrigation and water conservation. (Kahle-Fla)
W69-04167

PUBLIC UTILITIES - POWERS AND DUTIES.

N J Stat Ann sec 48:19-22 (1940); N J Stat Ann secs 48:19-13 to 48:19-20 (1968-69 Supp).

Descriptors: *New Jersey, *Public utilities, *Water supply, Legislation, State governments, Cities, Municipal water, Water consumption (Excludes consumptive use), Pipes, Conduits, Condemnation, Eminent domain, Administrative agencies, Roads, Reservoirs, Diversion, Legal aspects.
Identifiers: Water companies.

This section allows water companies to take and direct sources of water supply. They can build and maintain reservoirs, lay pipes, establish conduits, etc. Water companies may enter upon land for purpose of examination, measurements, and levelings when necessary. They may also take, use, or occupy any land or divert any spring or stream when necessary, providing the proper governmental agency has so authorized. The companies are allowed to lay pipes under such public roads, streets, etc, as is necessary. Such pipe must be three feet below the surface and not unnecessarily obstruct or interfere with public travel or damage public or private property. Procedure to obtain consent to lay such pipe is set forth in this article. Finally, the statute provides for a proportional refund on water rents by the water company to the consumer if water is not supplied for five days. 'Consumer' refers to individuals, firms, private, public, and municipal corporations furnished with water for any purpose other than motive power. (Logan-Fla)
W69-04199

PUBLIC UTILITIES - WATER POWER COMPANIES.

N J Stat Ann secs 48:14-14 (1940); N J Stat Ann secs 48:14-9 to 48:14-13, 48:14-15 to 48:14-19 (1968-69 Supp).

Descriptors: *New Jersey, *Dams, *Dam construction, *Electric power, Legislation, State governments, Public utilities, Cities, Canals, Laterals, Condemnation, Eminent domain, Backwater, Low water mark, Locks, Gates, Fish passages, Water pollution, Electric power, Potable water, Damages, Legal aspects, Diversion, Obstruction to flow, Water supply compensation.
Identifiers: Water power companies, Raceways.

This section allows water power companies, after taking a survey of the location, to enter and take possession of the land as a site for dam construction. Owners of the land must be fully compensated. The flow back and raising of the waters behind these dams cannot exceed ten feet above common low waters of these rivers and streams, and the companies may be required to construct the dam in such a manner as to allow for navigation and to provide for the passage of fish. The companies may construct canals or raceways (both main and lateral). All water so diverted must be returned to the rivers or streams as unpolluted as before it was so diverted. These companies cannot supply any municipality or the public with water for potable or other domestic use, and they are not entitled to damages for a diversion of the water of a stream or river for the water supply of a municipality. Finally, provisions are made herein for the erection of poles by the companies to sustain their wires and fixtures. (Logan-Fla)
W69-04200

3F. Conservation in Agriculture

PLAN FOR UTILIZING THE WATER RESOURCES OF THE UPPER KUBAN',
V. S. Konviz.
Hydrotech Constr, No 2, pp 87-93, Feb 1968. 7 p, 2 fig, 1 tab.

Descriptors: Water resources, *Water resources development, Rivers, Planning, River basin development, River basins, Hydroelectric power, Arid lands, Fish, Irrigation, Sprinkler irrigation, Flood irrigation, Rice, Irrigation canals, Canals, Foreign projects, Hydroelectric plants.
Identifiers: *Kuban' River (USSR), USSR, Hydroelectric resources.

Plans for completing the development of the Upper Kuban' River basin in Russia are outlined. A method of flood irrigation for a highly arid steppe region and a large flood irrigation project intended for rice growing are being investigated. The latter area will approach 250,000 ha in size. Other areas in the densely populated middle section of the basin are being evaluated. The entire water resources of the Kuban' River are estimated to provide flood irrigation for 9 million ha and sprinkler irrigation for 1 million ha; 7-8 cu km of water will be required annually for this purpose. Economically important fish life in the Sea of Azov, threatened by past construction operations, must be preserved in future development of the basin. Plans are outlined for using the hydropower resources of the Upper Kuban' basin, estimated to be 17.4 billion kwh/yr; 7-9 billion kwh/yr are in the European part of the USSR. (USBR)
W69-03767

MOISTURE STORAGE AND SPRING WHEAT YIELDS ON LEVEL-BENCH TERRACES AS INFLUENCED BY CONTRIBUTING AREA COVER AND EVAPORATION CONTROL,
Agricultural Research Service, Mandan, N. Dak.
H. J. Haas, W. O. Willis, and G. O. Boatwright.
Agronomy J, Vol 58, No 3, pp 297-299, May-June 1966. 3 p, 4 tab.

Descriptors: *Water storage, Water conservation, Evaporation control, *Wheat, Grasses, *Runoff, Fallowing, Erosion control, Bench leveling, Terracing, Spring, Crop production, Cover crops, Snowmelt, Cloudbursts.
Identifiers: Contributing area.

Purposes of the study were to determine the effect which different types of contributing area covers would have on both moisture storage and spring wheat yields on level bench terraces and how much moisture could be conserved by partial evaporation control of wheat from harvest to seeding time. Soil moisture storage on benches without a contributing area was about the same as on benches with a grass or wheat contributing area. Partial evaporation control increased moisture storage by an average of 2 inches for fallow and 1 inch for annual cropping. Principal advantages of level-bench terraces in arid climates appear to be preventing runoff of torrential-type rains, reducing erosion and increasing yields through moisture conservation. (Blecker-Arizona)
W69-03871

THE EFFECTS OF EVAPORATION, POTENTIAL TRANSPIRATION AND RAINFALL ON DEPLETION OF SOIL MOISTURE BY IRRIGATED PERENNIAL PASTURE,
State Research Farm, Werribee (Australia).
L. F. Bartels.
Aust J Exp Agric and Anim Husb, Vol 8, No 35, pp 720-724, Dec 1968. 5 p, 2 fig.

Descriptors: *Evaporation, Evaporation pans, Rainfall, Irrigation effects, Irrigation efficiency, Transpiration, Forecasting, *Soil moisture, *Irrigated land, *Pastures, *Moisture deficit, Semiarid climates, Drying, Regression analysis, Water loss, Weather data.
Identifiers: *Evaporimeters, Australia, Perennial, Soil moisture depletion, Penman's formula, *Evaporative index.

The predictability is discussed of soil moisture depletion from evaporation and rainfall measurements which were taken in Werribee, Australia. Depletion of soil moisture by an irrigated perennial pasture was shown to be closely related to an evaporative index (E-R), the accumulated difference between evaporation (E inches) and rainfall (R inches) subsequent to the last irrigation. This index was calculated for three types of evaporimeter, the standard Australian tank evaporimeter, the American Class A pan evaporimeter, and the Wright-Rain Irrigation Indicator. The index was directly proportional to the difference between Penman's potential transpira-

tion and rainfall, for drying cycles of more than 7 days duration. It was suggested that (E-R) might be a useful guide for irrigation scheduling, whether Penman's estimate of potential transpiration was found to be reasonably accurate. (Affleck-Arizona)
W69-03875

NITROGEN FERTILIZER AND WHEAT IN A SEMI-ARID ENVIRONMENT 4: EMPIRICAL YIELD RESPONSE MODELS AND ECONOMIC FACTORS,
Cunningham Lab., Brisbane (Australia).
J. S. Russell.
Aust J Exp Agr and Anim Husb, Vol 8, No 35, pp 736-748, Dec 1968. 13 p, 1 fig, 10 tab.

Descriptors: *Fertilizers, Rainfall disposition, Model studies, Statistical models, *Wheat, Forecasting, Economic feasibility, Soil moisture, *Nitrogen, *Crop response, Crop production, Equations, Rates of application, Climatic data, Variability, *Semiarid climates, Regression analysis, Profit.
Identifiers: *Australia, Parameters.

Difficulties in predicting grain yield response to applied nitrogen under conditions of low and variable rainfall were discussed in this report. Three models of grain yield response to applied nitrogen fertilizer for each of two strategies were proposed, based on data from field experiments carried out in South Australia. In the first strategy (nitrogen applied at sowing) the parameters were May-August rainfall, October mean maximum temperature and one of three alternative site criteria: initial soil nitrate content, 15-atmospheres soil moisture percentage, or estimated nitrogen status. In the second strategy (nitrogen applied in late winter) the parameters were similar, except that May-July rainfall replaced May-August rainfall. Response surfaces were examined using a calculated most profitable rate of application with a range of grain to fertilizer price ratios from 2 to 8. These calculations emphasized the importance of economic factors in affecting fertilizer use in areas where responses are small and variable. Limitations of the models and problems associated with the use of predicted climatic criteria were discussed. (Affleck-Arizona)
W69-03877

FERTILIZING DRYLAND SPRING AND WINTER WHEAT IN THE BROWN SOIL ZONE,
Agricultural Research Service, Bozeman, Mont.; and Agricultural Research Service, Huntley, Mont.
Paul L. Brown, and Ralph E. Campbell.
Agronomy J, Vol 58, No 3, pp 348-51, May-June 1966. 4 p, 5 tab.

Descriptors: *Fertilizers, Productivity, *Nitrogen compounds, Wheat, Phosphates, Dry farming, Precipitation (Atmospheric), *Brown soils, Moisture content, *Moisture availability, *Soil moisture, Montana, Crop response, Crop production, Winter, Spring, Moisture stress.

Wheat fertilizer research on dryland was conducted at Huntley, Montana, in order to determine responses of spring and winter wheat to nitrogen (N) and phosphorous (P) fertilization. In general, yields were directly related to precipitation during the growing season (April through July). From emergence to heading the N-P-fertilized plots used significantly more water than the water treatments. From heading to maturity, the N-P plots used significantly less water than the other treatments because the available supply was less. Supplemental soil moisture more than doubled average grain yields but was not enough to cause the fertilizer to increase grain yields above check treatment yields. Total water use from early joint to maturity was not significantly affected by fertilizer because all available water was used. Fertilization of wheat in an arid climate has a great deal of influence on the plant with respect to development, yield and soil moisture efficiency. (Blecker-Arizona)
W69-03878

ISOLATION AND CHARACTERIZATION OF HYDROLOGIC RESPONSE UNITS WITHIN AGRICULTURAL WATERSHEDS,
Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
C. B. England, and C. A. Onstad.
Water Resources Research, Vol 4, No 1, pp 73-77, June 1968. 5 p, 4 fig, 1 tab.

Descriptors: *Hydrologic data, *Hydrologic aspects, *Watersheds (Basins), *Soil groups, Soil formation, Soil physical properties, Runoff, Hypsometric analysis, Parametric hydrology, Topography, Infiltration, Petrography, Geomorphology.
Identifiers: *Hydrologic response units.

To extrapolate hydrologic relations from small to large areas, a watershed can be partitioned by isolation of units of relative homogeneity with respect to soil type, landform and land use that fall into a sequence compatible with the hydraulics of overland and subsurface flows. Size and distribution of hydrologic response units of different characteristics within a watershed may profoundly affect the areal-and time-distribution of potential over the area. Partitioning the hypsometric curve on the basis of soil group distribution may offer some clues as to the differences in hydrologic behavior of different sized watersheds within a given area. The methods discussed in the paper can be applied to arid watersheds to determine their hydrologic response performance. (Blecker-Arizona)
W69-03879

CONSERVATION BENCH TERRACES IN EASTERN COLORADO,
Agricultural Research Service, Akron, Colo. Soil and Water Conservation Research Div.
Rome H. Mickelson.
Trans of the American Soc of Agricultural Engineers, Vol 11, No 3, pp 389-392 May-June 1968. 4 p, 3 fig, 4 tab.

Descriptors: Runoff, *Fallowing, *Land forming, *Water storage, Soil water, Water utilization, *Terracing, Rainfall-runoff relationships, Erosion control, Colorado, *Bench leveling, Crop production, Conservation, Land management, Sorghum, Precipitation (Atmospheric).

Research was done at Akron, Colorado, on conservation bench terraces in order to determine the optimum ratio of contribution to level bench area on silt loam soils: runoff from two cropping systems on the contributing area; and relationship between available water supplies and crop yields. Benches with fallow contributing areas gained 4.1 inches of soil water, compared with 3.5 inches in benches with sorghum contributing areas. In general, benches with fallow were more efficient in water utilization. Level-bench terraces in arid areas are an improvement over the conventional ridge terrace because they distribute water over a larger area and they can be designed to provide storage for higher intensity storms. (Blecker-Arizona)
W69-03880

LEVEL PAN CONSTRUCTION FOR DIVERTING AND SPREADING RUNOFF,
Agricultural Research Service, Akron, Colo. Soil and Water Conservation Research Div.
Rome H. Mickelson.
Trans of the American Soc of Agricultural Engineers, Vol 9, No 4, pp 568-70, 1966. 3 p, 2 fig, 5 tab.

Descriptors: Water storage, *Runoff, *Land forming, Flood routing, Moisture content, Fallowing, *Rainfall-runoff relationships, Crop response, Evaporation control, *Water spreading, Watersheds (Basins), Economic feasibility, Moisture availability, *Dry farming, Water utilization, Water management, Land management.
Identifiers: *Level pans.

The spreader system used in this experiment involved leveled areas (pans) that were constructed in natural drainage ways in order to intercept, spread and store the runoff that normally flowed through them. The experiment was to evaluate the economic feasibility of utilizing watershed runoff on leveled dryland areas for annual cropping, to study management problems and to observe response of different crops to intermittent flooding. Available moisture content in unleveled continuously cropped area was about half of that in level pans. Level pans located in arid climates conserve and utilize the moisture more efficiently than fallow or annual cropping on unleveled areas. (Blecker-Arizona)
W69-03881

WATER DISTRIBUTION UNDER SPRINKLER IRRIGATION,
Agricultural Research Service, Kimberly, Idaho. Snake River Research Center.
Claude H. Pair.
Transactions of the ASAE, Vol 11, No 5, pp 648-651, Sept-Oct, 1968. 4 p, 7 tab.

Descriptors: *Irrigation efficiency, *Irrigation systems, *Water distribution (Applied), *Sprinkler irrigation, Wind velocity, Rates of application, *Uniformity coefficient, Laterals, Infiltration, Idaho, Distribution systems.

Water distribution from a handmove sprinkler system was studied during a normal irrigation season in southern Idaho. Five types of sprinkler systems operating individually and three types of systems operating simultaneously had uniform sprinkler heads, nozzle sizes, sprinkler spacing on the lateral, nozzle pressure and wind conditions. Water distribution was compiled from spray catch cans. Comparison of water distribution from three types of sprinkler systems operating simultaneously showed that the straight-lateral, self propelled sprinkler gave a higher coefficient of uniformity than the handmove or side move with trailer line systems. Multiple irrigations by handmove portable sprinkler laterals gave acceptable seasonal water distribution as measured by the Christiansen coefficient of uniformity, even though some individual irrigations yielded poor water distribution. (Affleck-Arizona)
W69-03892

FUTURE IRRIGATION DEMAND IN THE SUSQUEHANNA BASIN,
Chesapeake Bay-Susquehanna Rivers Basins Project, Susquehanna Field Station.
Howard Miller.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6278, pp 391-399, Dec 1968. 9 p, 2 fig, 8 tab, 2 ref.

Descriptors: *Irrigation, *Forecasting, *Water utilization, Pennsylvania, New York, Low flow, Droughts, Water loss, Water resources, Water supply, Seepage.
Identifiers: Susquehanna River Basin.

Some years hence, during drought years, irrigation probably will have significant and locally detrimental effects on the surface water economy of the Susquehanna Basin, that is, barring changes in water laws or watershed development projects. Support for the theory that practice of irrigation will grow comes from an analysis of rainfall frequency and crop production deficiencies in drought years. From this, average annual profit per acre can be estimated. From designs of irrigation systems under a range of conditions, annual costs per acre can be estimated. By logic it can be assumed that crops with the greatest profit potential will be irrigated in the future. Tempering the synthetic predictions with consideration of current irrigation practice and trends, predictions of future irrigation withdrawals are made. Whether irrigation withdrawals will be significant or detrimental depends on amounts of streamflow available during drought periods and the frequency of such drought occurrences.
W69-03934

SURFACE IRRIGATION HYDRAULICS-KINEMATICS,
California Univ., Davis. Dept. of Water Science and Engineering; and Washington State Univ., Pullman. Dept. of Agricultural Engineering.
William E. Hart, Day L. Bassett, and Theodor Strelkoff.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6284, pp 419-440, Dec 1968. 22 p, 8 fig, 18 ref, 3 append.

Descriptors: *Surface irrigation, *Infiltration, Storage, Hydraulics, Mathematical models, Mathematical studies, Unsteady flow, Non-uniform flow, Open channel flow, Recession curves.
Identifiers: Irrigation water advance, Irrigation water recession.

The mathematical solutions of surface irrigation flow and infiltration are reviewed. Their similarities lead to easy classification and simplification. An approach is proposed which uses defined shape factors to solve the advance of water, surface storage, storage depletion, recession, and infiltration during unsteady nonuniform flow over a porous bed. True solutions of the mass-conservation equation are analyzed and compared. Methods of numerically solving the equations are developed and discussed. Solutions are presented as dimensionless advance curves which can be used for field applications. (Knapp-USGS)
W69-03936

ROLE OF IRRIGATION IN THE WEST'S EXPANDING ECONOMY,
Bureau of Reclamation, Washington, D. C.
Floyd E. Dominy.
ASCE Proc, J Irrig and Drainage Div, Vol 94, IR4, Pap 6281, pp 401-418, Dec 1968. 18 p, 3 fig, 5 tab, 24 ref.

Descriptors: *Irrigation, *Irrigation programs, *Cost-benefit ratio, *Multiple-purpose projects, *Economic impact, Agriculture, Reclamation, Resource allocation, Social aspects, Water demand.
Identifiers: *Bureau of Reclamation, Western U.S.

Since 1902 the Bureau of Reclamation has developed water supplies and facilities for about 8,000,000 acres of irrigated land. About one-third of this acreage was formerly raw land not previously used for crop production. Goals of the Federal Reclamation Program include: (1) Efficient use of resources; (2) economic growth to meet future requirements for national security; (3) an expanding economy, and adequate production capacity; (4) equitable sharing of national resources; (5) water and land conservation; (6) and social and economic development of Indian and other groups. Irrigation, originally a dominant purpose, has been joined by hydroelectric power, municipal and industrial water, recreation, flood control, and fish and wildlife enhancement. In addition to the creation of permanent local economic bases. irrigation builds markets and commerce by virtue of the induced demands for goods used in construction and operation of the project and the farms.
W69-03940

WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
Aarhus Univ. (Denmark). Inst. of Economic and Applied Geography.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03949

QUALITY OF SURFACE WATERS FOR IRRIGATION, WESTERN STATES, 1963,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03968

GEOLOGY AND WATER RESOURCES IN THE FRENCH PRAIRIE AREA, NORTHERN WILLAMETTE VALLEY, OREGON,
Geological Survey, Washington, D. C.
Don Price.
Geol Surv Water-Supply Pap 1833, 1967. 98 p, 18 fig, 2 plate, 7 tab, 33 ref.

Descriptors: *Water management (Applied), *Stratigraphy, *Surface waters, *Groundwater, Precipitation (Atmospheric), Recharge, Irrigation wells, Water chemistry, Oregon.
Identifiers: *Northern Willamette Valley, French Prairie Area, Willamette River, Pudding River.

Methods to determine the efficient development and effective management of the groundwater resources in the French Prairie area were studied in an attempt to supplement the meager summer precipitation during the main growing season. Nearly 600 wells are used for irrigation in this area, and the chemical suitability of the groundwater for this and other purposes was evaluated. Water quality from most wells tapping nonmarine sedimentary rocks was found to be excellent for irrigation; however, water from several wells contained objectionable concentrations of dissolved iron. The groundwater reservoir is recharged during winter months by downward percolation of precipitation, and is drained naturally by evapotranspiration and by discharge through seeps and springs. There is little natural recharge during summer months and the water table declines less than 5 ft along the alluvial plains and more than 20 ft in parts of French Prairie. (Llaverias-USGS)
W69-03977

GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
Geological Survey, Washington, D. C.
Marlin E. Lowry, and Marvin A. Crist.
Geol Surv Water-Supply Pap 1834, 1967. 71 p, 16 fig, 2 plate, 4 tab, 42 ref.

Descriptors: *Groundwater, *Surface waters, *Water quality, Water resources, Aquifers, Irrigation, Wells, Water utilization, Wyoming.
Identifiers: *Laramie County, *Pine Bluff-Carpenter area.

Tabular data are presented on the effect of the development of groundwater on the hydrology of the area, the hydraulic properties of the aquifers and the extent to which water can be developed from them. The total amount of groundwater pumped from wells in Laramie County during 1964 is estimated to be 28,000 acre-ft, of which 6,000 acre-ft was used for municipal and industrial supplies, 17,000 for irrigation in the Pine Bluffs-Carpenter area, and about 5,000 for other purposes. Large quantities of water suitable for irrigation can be obtained by deeper wells drilled in the north central part of the country. Groundwater supplies have been intensively developed for municipal use near Cheyenne and Federal, and for irrigation use in the Pine Bluffs lowland. The chemical quality of water from the principal aquifers and streams is generally suitable for domestic, irrigation, and industrial uses. (Llaverias-USGS)
W69-03979

STOMATA IN RELATION TO DROUGHT RESISTANCE OF WHEAT VARIETIES,
West Pakistan Agricultural Univ., Lyallpur. Dept. of Plant Breeding and Genetics.
Khrushid Alam, and Muhammad Yusuf.
Pakistan Jour of Sci Res, Vol 19, No 4, pp 171-179, Oct 1967. 1 fig, 4 tab.

Descriptors: *Drought resistance, *Stomata, *Wheat, *Moisture stress, *Pores, Diurnal, Arid lands, Evapotranspiration, Plant physiology, On-site data collections, Frequency.
Identifiers: *West Pakistan, Carnoy's fluid.

A study was conducted of the stomatal mechanism operative in several local and exotic wheat varieties together with its relationship with their drought enduring capacity. The daily activity of the stomata and their size and frequency were studied using Carnoy's fluid to arrest instantly the stomatal movements. Data indicated that varieties having a larger frequency of small sized stomata were more drought resistant than the varieties with larger stomatal pores. This combination can be used, therefore, as a criterion for selection of varieties suitable for cultivation under moisture stress conditions. This problem of drought resistance is of considerable importance in West Pakistan, where a significant portion of wheat acreage is located in areas where artificial means of irrigation are lacking or are inadequate. (Affleck-Ariz)
W69-04117

ECO-PHYSIOLOGICAL STUDIES ON PLANTS IN ARID AND SEMI-ARID REGIONS IN WESTERN AUSTRALIA. I. AUTECOLOGY OF RHAGODIA BACCATA (LABILL.) MOQ,
Western Australia Univ., Nedlands. Dept. of Botany.
Erhart O. Hellmuth.
Jour of Ecology, Vol 56, No 2, pp 319-344, July 1968. 13 fig, 7 tab.

Descriptors: *Ecology, *Plant physiology, *Draught resistance, *Heat resistance, *Photosynthesis, Arid climates, Semiarid climates, Water loss, Soil moisture, Osmosis, Moisture deficit, Shrubs.
Identifiers: *Autecology, *Australia, *Coastal saltbush.

Investigations were conducted on the autecology of Rhagodia baccata, which is highly valued as a pasture species in certain arid and semi-arid regions of Western Australia. This species was shown to exert marked control over water loss and to have a higher net assimilation rate than other native plants of Western Australia investigated so far. It was found to have high heat resistance. These drought-resistant properties, together with its capacity to grow on a wide range of soil types, its ease of propagation, and its papatability for sheep, make R baccata potentially useful as a pasture plant for the arid and semi-arid regions of Western Australia. (Affleck-Ariz)
W69-04118

AN ANALYTIC APPROACH TO DETERMINE IRRIGATION SPRINKLER SPACING,
Minnesota Univ., St. Paul.
Tung Chu Shu, and E. R. Allred.
Transactions of the ASAE, Vol 11, No 4, pp 540-545, July-Aug 1968. 8 fig, 2 tab.

Descriptors: *Sprinkler irrigation, *Spatial distribution, *Analytical techniques, *Networks, *Irrigation systems, Equations, Depth, Uniformity coefficient, Regions, Irrigation design, Mathematical studies, Water distribution (Applied), Rotations.
Identifiers: Parameters, Non-uniformity.

One of the important problems in the design of an irrigation system using rotating sprinklers is arrangement of sprinklers so that over-all distribution of water is uniform. The conventional method for determining appropriate spacing for a system of rotating irrigation sprinklers is based on use of the uniformity coefficient. The purpose of this paper was to derive an expression of nonuniformity by considering the depth of water of a network of sprinklers as a continuous function. In order to reduce laborious calculation procedures, and to obtain a more clear understanding of the problem, nonuniformity was expressed in terms of the depth of an isolated sprinkler. (Affleck-Ariz)
W69-04121

COMMERCE AND TRADE: MINING BUREAU.

Me Rev Stat Ann, tit 10, secs 2103 (5), 2108, 2109 (1964).

Descriptors: *Maine, *Legislation, *Mining, *Water rights, Excavation, Mineral industry, Pumping, Boundaries, Royalties, State governments, Locating, Mapping, Permits, Ownership of beds, Dam construction, Ditches, Mining engineering, Tunnels, Bodies of water.
Identifiers: Prospecting, Buoy markers.

The statute describes the methods by which a person or corporation with a prospector's permit may locate his claims by defining the boundaries. If the claim extends into a body of water, he may locate his claim by establishing a post or buoy markers. As an alternative, he may place posts on dry land which are marked with the exact distances and directions to over-water claims. A person or corporation in possession of a recorded claim shall have the rights to any minerals and metals except water, sand, and gravel. Any person with a license to mine may receive a permit allowing him to construct and use ditches or pipes over public lands, together with the right to construct dams, to bring in water necessary for mining operations. The State receives a royalty on all mined commodities produced from mineral deposits below bodies of water to which the State has title. (Stewart-Fla)
W69-04165

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on THE Surface

FLOOD PLAIN INFORMATION-HUTTON BRANCH AND COOKS BRANCH, DALLAS COUNTY, TEXAS.
Corps of Engineers, Fort Worth, Tex.

Corps Eng Flood Plain Rep, Oct 1968. 59 p, 9 fig, 18 plate, 17 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Texas, Maximum probable flood, Rainfall-runoff relationships, Urbanization.
Identifiers: Dallas County (Tex), Carrolton (Tex), Renner (Tex), Trinity River (Tex), Hutton Branch (Tex), Cooks Branch (Tex), Standard Project Flood, Intermediate regional flood.

Flooding on Hutton Branch and Cooks Branch, tributaries of the Elm Fork of the Trinity River, Dallas County, Texas, is described in a report of the flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03707

FLOOD PLAIN INFORMATION - VOLUME IV OF DENVER METROPOLITAN REGION, COLORADO.
Corps of Engineers, Omaha, Nebr.

Corps Eng Flood Plain Rep, Oct 1968. 62 p, 32 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Colorado, Maximum probable flood, Urbanization.
Identifiers: Denver (Colo), South Platte River (Colo), South Platte River tributaries (Denver-Colo), Standard project flood, Intermediate regional flood.

Flooding of the tributaries of the South Platte River in the Denver Metropolitan area, Colorado, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03708

FLOOD PLAIN INFORMATION OF CONGAREE CREEK AND SIX MILE CREEK IN LEXINGTON COUNTY, SOUTH CAROLINA.
Corps of Engineers, Charleston, S. C.

Corps Eng Flood Plain Rep, Jan 1969. 52 p, 8 fig, 34 plate, 9 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Flood protection, Non-structural alternatives, South Carolina, Maximum probable flood.
Identifiers: Congaree Creek (SC), Six Mile Creek (SC), Lexington (SC), Standard project flood, Intermediate regional flood.

Flooding of Congaree Creek and Six Mile Creek, Lexington, South Carolina, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03709

FLOOD PLAIN INFORMATION-PETERS CREEK AND LICK RUN, ROANOKE, VIRGINIA.
Hayes, Seay, Mattern and Mattern, Roanoke, Va.

Corps Eng Flood Plain Rep, Aug 1968. 33 p, 5 fig, 11 plate, 10 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Virginia, Maximum probable flood.
Identifiers: Roanoke (Va), Peters Creek (Va), Lick Run (Va), Intermediate regional flood, Standard project flood.

Flooding of Peters Creek and Lick Run, Roanoke, Virginia is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03710

PRELIMINARY FLOOD PLAIN INFORMATION-CHATTAHOOCHEE RIVER, BUFORD DAM TO METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.

Corps Eng Prelim Flood Plain Rep, 1968. 9 p, 2 fig, 11 maps.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Flood protection, Non-structural alternatives, Georgia, Maximum probable flood.
Identifiers: Chattahoochee River (Ga), Atlanta (Ga), Standard project flood, Intermediate regional flood.

Flooding of the Chattahoochee River, Atlanta, Georgia, is described in a preliminary report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03711

FLOOD PLAIN INFORMATION - FOUNTAIN CREEK, PUEBLO, COLORADO.
Corps of Engineers, Albuquerque, N. Mex.

Corps Eng Flood Plain Rep, Oct 1968. 45 p, 10 fig, 16 plate, 11 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Colorado, Maximum probable flood.
Identifiers: Pueblo (Colo), Fountain Creek (Colo), Standard project flood, Intermediate regional flood.

Flooding on Fountain Creek at Pueblo, Colorado is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03712

FLOOD PLAIN INFORMATION-OUACHITA RIVER, CAMDEN, ARKANSAS.
Corps of Engineers, Vicksburg, Miss.

Corps Eng Flood Plain Rep, Sept 1968. 29 p, 11 fig, 9 plate, 5 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Arkansas, Maximum probable flood.
Identifiers: Camden (Ark), Ouachita River (Ark), Standard project flood, Intermediate regional flood.

Flooding of the Ouachita River at Camden, Arkansas is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03713

FLOOD PLAIN INFORMATION-CUMBERLAND RIVER AND OBEY RIVER, CELINA, TENNESSEE.
Corps of Engineers, Nashville, Tenn.

Corps Eng Flood Plain Rep, Oct 1968. 53 p, 8 fig, 14 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Tennessee, Maximum probable flood.
Identifiers: Celina (Tenn), Cumberland River (Tenn), Obey River (Tenn), Standard project flood, Intermediate regional flood.

Flooding of the Cumberland and Obey Rivers at Celina, Tennessee is described in a report of flood plain problems based on records of rainfall, runoff, and historical and current flood heights. Prediction of future flood heights takes into account the backwater effects of a major dam now under construction. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulation, the construction of flood control works, or by combinations of these approaches. (Knapp-USGS)
W69-03714

FLOOD PLAIN INFORMATION, CHRISTINA RIVER, MUDDY AND BELLTOWN RUNS, NEW CASTLE COUNTY, DELAWARE.
Corps of Engineers, Philadelphia, Pa.

Corps Eng Flood Plain Rep, Oct 1968. 47 p, 7 fig, 14 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Delaware, Maximum probable flood.
Identifiers: Christina River (Del), Muddy Run (Del), Belltown Run (Del), Standard project flood, Intermediate regional flood, Wilmington (Del).

Flooding of the Christina River, Muddy Run, and Belltown Run, New Castle County, Delaware, is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03715

THE TEXAS WATER PLAN.
Texas Water Development Board, Austin.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03729

GEOLOGICAL CONSIDERATIONS IN THE DESIGN OF RESERVOIR SEEPAGE CONTROL SYSTEMS,
For primary bibliographic entry see Field 08A.
For abstract, see .
W69-03763

POWER GENERATION UNDER IJC REGULATION,
New York State Power Authority, Niagara Falls.
George T. Berry.
Proc Amer Soc Civ Eng, J Power Div, Vol 94, No P02, pp 217-231, Nov 1968. 15 p, 9 fig, 1 tab, 2 ref, append.

Descriptors: *River regulation, Flood control, Pumped storage, Lakes, *Navigation, Water resources, *Hydroelectric power, Streamflow records, *Electric power production, Streamflow, Regulated flow, St. Lawrence River, Economics, Inflow, Outflows, Feasibility, Great Lakes, Lake Erie, *Lake Ontario.
Identifiers: *Operating criteria, Niagara River, Niagara Falls, Great Lakes Power Dvlpmt., St. Lawrence Power Project (Canada).

The International Joint Commission and its Boards of Control comprise the principal authority prescribing the limits within which the hydroelectric resources of the St. Lawrence and Niagara Rivers are put to use. To facilitate developing regulation plans appropriate for presently existing Great Lakes Basin conditions, a homogeneous set of unregulated Lake Ontario levels and flows consistent with existing diversion to and from the Great Lakes, existing Lake Superior regulation, and existing stage-discharge relationships for the connecting channels were derived by adjusting the natural record for changes to these factors. Criteria used for developing Lake Ontario regulation plans are given. Regulation plans have evolved as experience has been gained, resulting in better use of water resources. Flexibility in the St. Lawrence releases and pumped storage facilities at the Niagara Project can be used to improve efficiency and reduce the cost of power required from thermal sources to meet New York power needs. Studies are underway to determine how much additional value Niagara power output would have if Lake Erie outflows were controlled. (USBR)
W69-03781

DRAINAGE OF AGRICULTURAL LAND; AN ANNOTATED BIBLIOGRAPHY OF SELECTED REFERENCES, 1956-1964,
National Agricultural Library, Washington, D. C.; and Agricultural Research Service, Beltsville, Md. Soil and Water Conservation Research Div.
Charles B. Crook.
U S Department of Agriculture, National Agricultural Library, Library List 91, pp 1-524, July 1968. 524 p.

Descriptors: *Drainage engineering, Subsurface drainage, Surface drainage, Construction equipment, Hydraulic structures, Land management, Farms.

Many publications have been written throughout the world on drainage research and its applications. Since 1955, materials such as plastics have opened up new fields of drainage and seepage control; machinery has been developed for all types of drainage materials; new methods have been used to speed up drainage; improved practices have been developed for irrigation and salinity control; and better maintenance has helped solve some of the problems of drainage in the field. Moreover, research in related areas such as soil physics, hydrology, and hydraulics has created new instruments and techniques which have improved drainage procedures. To keep up with the demand for information on both surface and subsurface drainage, this annotated bibliography has been compiled. It brings up-to-date 'Drainage of Agricultural Land, a Bibliography of Selected References', by E. G. Davis and M. L. Gould, published in May 1956 as U. S. Department of Agriculture, Miscellaneous Publication no. 713. Arrangement is alphabetical under broad subject classification. Call numbers following citations are those used in the National Agricultural Library.
W69-03809

MCFARLAND V DEKALK COUNTY (DAMAGES ATTRIBUTABLE TO SURFACE WATER NUISANCE).
163 SE 2d 827-829 (Ga 1968).

Descriptors: *Georgia, *Drainage water, *Damages, *Surface runoff, Judicial decisions, Legal aspects, Surface waters, Condemnation, Cities, Easements, Water law.
Identifiers: Nuisance.

Plaintiff brought an action for damages and to enjoin defendant from continuing trespass by reason of dumping increased quantities of surface waters onto plaintiff's land. The defendant, a local governmental unit, had an easement to dump surface waters on plaintiff's land received from upper areas by gravitation. The plaintiff claimed that defendant had increased the quantities of waters dumped over that which had been dumped in previous years. The court held that evidence of damages to plaintiff's land due to the increased dumping of waters was proper for jury consideration. Such activity would be a continuing nuisance authorizing an equity court to restrain it and to require defendant to cease and desist until and unless land was condemned for public purposes. Furthermore, plaintiff was allowed to show all damages resulting up to and until the time of showing the existence of a permanent nuisance. (Holt-Fla)
W69-03812

FLOOD PROTECTION.

N Y Conserv Law dec 835, art 6 secs 6.1, 6.2 (McKinney Supp 1968).

Descriptors: *New York, *Flood control, *Flood plains, *Classification, Civil law, Legislation, State governments, Administrative agencies, Conservation, Planning, Flood damage, Flood protection, Multiple-purpose projects, Watershed management, Flood plain zoning, Non-structural alternatives, Economic feasibility, Public health, Standards, Legal aspects.

The conservation commission must propose and implement projects and facilities it deems necessary for flood plain development and flood damage reduction. The commission should classify lands with reference to flooding, and establish standards for flood plain use which will promote economic development and protect public health, welfare, and property. These standards should be adopted only after interested persons have been given notice and an opportunity to be heard. In addition, when adopting, amending, or repealing such standards, the commission should consider the effect of particular uses of the flood plain on the health and safety of persons and property, the economic and technical feasibility of measures available for developing the flood plain and the responsibilities, if any, of local, state and federal governments connected with the use or proposed use of the flood plain. (Scott-Fla)
W69-03813

PETERS V AUBIN (ACTION TO RESTORE WATERCOURSE).
242 NE 2d 427-430 (Mass Sup Jud Ct 1968).

Descriptors: *Massachusetts, *Obstruction to flow, *Watercourses (Legal), *Natural flow, Landfills, Judicial decisions, Water law, Downstream, Upstream, Floodwater, Flood damages, Backwater, Channels, Culverts, Remedies, Waterways, Depth, Width, Dimensions.

Defendant filled and blocked a watercourse across her land. The obstruction of the flow caused flooding of the upstream owner's land. The upstream owner filed suit in equity to require the defendant to restore the watercourse. The lower court ordered defendant to restore the watercourse to a specific depth and width, taking into consideration the dimensions of the channel at the point it entered defendant's land from the next upland property. The appellate court affirmed, but modified the decision in part. The court stated that the downstream owner should not be required to make the land of upstream owner less subject to flooding than before the obstruction to flow. The modified decree also allowed defendant to excavate an alternative watercourse to give the desired relief, ruling that an upstream owner's right is not interfered with by a change by a downstream owner, provided the full and free flow is not dimished or impeded. (Wheeler-Fla)
W69-03816

MILLER V DARBY (DIVERSION OF SURFACE WATERS).
143 NE 2d 816-819 (Mass 1957).

Descriptors: *Massachusetts, *Surface drainage, *Surface waters, *Diversion, Judicial decisions,

Natural flow doctrine, Drainage, Alteration of flow, Ditches, Relative rights, Landfills, Trenches, Culverts, Roads, Overflow, Drains, Channels, Reservoirs, Prescriptive rights, Legal aspects, Surface runoff, Floods.

Plaintiff and defendant owned adjacent parcels of land. Plaintiff sought an injunction restraining defendant from discharging water upon plaintiff's premises. Defendant filled in his property, and in so doing left a narrow strip unfilled, thus creating a kind of trench near the bottom of which was exposed a culvert used to drain plaintiff's basement. This culvert ran from plaintiff's basement under a public road and discharged upon defendant's lot; this privilege rested upon the oral permission of defendant's predecessor in title, and was revocable at will by defendant. After defendant's lot was filled, plaintiff had serious trouble from the flooding of her cellar. Plaintiff plugged up the drain herself, and sought injunctive relief to prevent the reoccurance of the flooding. The court held that where defendant's predecessor in title knew when he conveyed to the defendant of the existence and purpose of the culvert, plaintiff had a prescriptive right to have the culvert maintained. Even though obstruction or alteration of surface water flow by a landowner affords no cause of action in behalf of a person who may suffer loss from such actions, he has no right to collect surface waters into artificial channels or reservoirs and then release the captive waters by a culvert or other artificial means upon the land of his neighbor. The court held that the collection of the surface water in the trench and the discharging of it by means of the culvert upon plaintiff's land constituted a continuing trespass, and granted the injunction. (Scott-Fla)
W69-03823

WIESE V MIEHER (ALTERATION OF DRAINAGE).
14 Ill App 2d 126, 143 NE 2d 404 (1957).

Descriptors: *Illinois, *Drainage, *Surface drainage, *Diversion, Judicial decisions, Natural flow doctrine, Surface waters, Alteration of flow, Ditches, Relative rights, Legal aspects, Cultivation.
Identifiers: Upper landowners, Lower landowners.

Plaintiff sought an injunction to prevent defendant from draining his land in a southerly direction into and over the lands of the plaintiff and to compel defendant to drain the property in a northerly direction, alleging that natural drainage of the property was, and had been for the past sixty years, to the north. The court, in granting the injunction, held that while the owner of upland property may cultivate it according to good methods of husbandry, he has no right to collect surface waters from his lands and divert and deposit them in undue and unnatural quantities upon the lands of his neighbor by the construction of ditches or other artificial structures. If he attempts to do so, a court of equity will intervene, as in this case, to prevent such acts. (Scott-Fla)
W69-03824

KEISER V MANN (DIVERSION OF SURFACE WATERS).

143 NE 2d 146-149 (Ct App Ohio 1956).

Descriptors: *Ohio, *Landfills, *Surface drainage, *Diversion, Judicial decisions, Natural flow doctrine, Drainage, Surface waters, Alteration of flow, Legal aspects, Reasonable use, Relative rights.
Identifiers: Upper landowners, Lower landowners.

Plaintiff sued defendants for damages to his property that were allegedly caused when defendants filled in their property with earth, gravel and shale, completely destroying natural drainage so as to divert surface waters from a creek onto plaintiff's premises. The court stated that in urban areas the owner of a lot that receives the natural flow of surface water from an adjoining lot may divert the natural flow of such water by filling his lot or by erecting structures on it without liability arising in favor of the adjoining owner, so long as such filling and erecting is done in a reasonable manner. The evidence tended to show that after defendants' lot was filled in it still was lower than the road which separated their lot from that of the plaintiff. Therefore, plaintiff had failed to establish that defendants had acted in an unreasonable manner or that any water flowed from defendants' land onto plaintiff's land. The action was dismissed. (Scott-Fla)
W69-03825

SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).

143 Conn 476, 123 A 2d 468-470 (1956).

Descriptors: *Connecticut, *Drainage effects, *Natural flow doctrine, *Alteration of flow, Judicial decisions, Drainage water, Surface runoff, Surface waters, Drainage, Drainage practices, Water law, Water rights.
Identifiers: *Governmental immunity.

Plaintiff owned a parcel of land bordering on defendant's property. Defendant had bought his land subject to a right of way for drainage over, under, and across given to the State of Connecticut. Co-defendant state highway commissioner had catch basins and culverts constructed to collect and discharge surface water from a nearby road. This water went onto plaintiff's land causing damage. Plaintiff sued to enjoin the discharge of the water. The court, in holding for the defendants, noted that it is illegal to diver the natural flow of water in such a manner as to divert it upon, and to the detriment of, a neighbor's land. However, it was held that since this action was against the highway commissioner, it was in effect against the State. Therefore it could not be maintained without the State's consent - which apparently was not given. (Heckerling-Fla)
W69-03833

YENCHKO V GRONTKOWSKI (ACTION FOR DAMAGE DUE TO INTERFERENCE WITH NATURAL FLOW OF SURFACE WATERS).

385 Pa 272, 122 A 2d 705-706 (1956).

Descriptors: *Pennsylvania, *Surface runoff, *Obstruction to flow, *Natural flow, Surface drainage, Damages, Storm runoff, Floodwater, Lakes, Surface waters, Water law, Judicial decisions, Drainage rain water, Drainage systems, Legal aspects.
Identifiers: Trespass, Act of God.

Defendants owned land, with a lake, which was used as a park. Plaintiffs owned adjacent land devoted to housing development. The natural flow of surface waters had been from defendants' land toward plaintiffs' land, but to a considerable extent in a direction towards the lake. Defendants deposited dirt along a side of the lake, and knowingly allowed an intake pipe, leading to the lake, to be blocked with rags. Upon a heavy rainstorm, large volumes of water were diverted to plaintiffs' land. Plaintiffs brought a trespass action to recover flood damages, and were able to show at trial that the damage was caused by defendants' interference with the natural flow of surface waters. Judgment for plaintiffs was entered. On appeal, defendants argued insufficiency of evidence, and asserted an act of God as a defense. In affirming the court ruled that evidence was sufficient, and held that the burden is on the party asserting the defense of act of God to produce proof of its effect, which defendants failed to do. (Wheeler-Fla)
W69-03834

PASHLEY V UNITED STATES (FLOOD DAMAGE THROUGH ERECTION OF DAM).

156 F Supp 737-740 (Ct Cl 1957).

Descriptors: *Dam failure, *Eminent domain, *Flood damage, Colorado River Basin, Columbia River Basin, Floodwater, Watersheds, Reservoir sites, Water levels, Flood control, Flood protection, Land use, Washington, Dams, Dam construction, Damsites, Flooding, Foundation failure.

Plaintiff landowners here bring a successful eminent domain action against the United States for flood damage for devaluation of mineral extraction rights of sodium sulphate deposits. Plaintiffs contended that the flooding was the direct and natural consequence of the erection of the O'Sullivan Dam, a part of the Columbia Basin Project of the Bureau of Reclamation. The United States Court of Claims agreed with this contention on the ground that defendant knew that impounding water above the dam would probably cause property below the dam to be inundated due to defendant's exhaustive geological investigation and the great pains taken by defendant to prevent water seepage from the dam. The case contains a great deal of geographic and historical information concerning the Columbia River Basin. (Carruthers-Fla)
W69-03835

DRAINAGE.
NJSA secs 40:30-1 to 40:30-21 (1967).

Descriptors: *New Jersey, *Drainage districts, *Financing, *Direct benefits, Taxes, Legislation, Legal aspects, Contracts, Surface water, Assessments, Appropriation, Bridges, Watercourses (Legal), Drainage, Cities, Ditches, Administration, Administrative agencies.
Identifiers: *Drainage commission, Bonds, Administrative appropriations.

Districts of any county which have drainage problems detrimental to public health may petition the Superior Court to provide plans for the erection of a drainage system. A commission is subsequently appointed to implement the plan. County bonds may be issued to pay for the drainage works. Lands benefited by the works are assessed to provide for payment of the bonds. If the assessments are insufficient to pay the costs of drainage works, county taxes are to be used to pay the excess. Additional expenses necessary to provide drainage works requiring annual expenditures are to be appropriated by the board of freeholders. Any county may construct, operate, and maintain ditches or watercourses necessary to control the flow of surplus and surface waters. Construction of bridges and roads across the ditches and watercourses is within the board's power. The board can acquire property necessary for exercising its drainage powers. The board of freeholders is authorized to provide for payment of any work authorized herein. The board can contract with any municipality in the county to share costs of drainage works therein. (Holt-Fla)
W69-03839

SURFACE DRAINAGE.

N J Stat Ann sec 40:63-20 (1967).

Descriptors: *New Jersey, *Surface water, *Surface drainage, *Roads, Drains, Construction, Legislation, Local governments, Cost, Payment, Administrative agencies.

When the governing body of any municipality finds it necessary to construct a drain for surface water in any county road of the county in which the municipality is located, and the board of chosen freeholders of the county shall have approved the plans for the proposed drain and shall have appropriated a specific sum towards its construction with the proviso that the municipality shall construct the drain and that the municipality shall pay the balance of the cost thereof, then, and in such case, the governing body may, by ordinance or resolution, cause such drain to be constructed, and may provide for the payment of the balance of the cost thereof. (Shevin-Fla)
W69-03859

ENTRY ON LAND TO MAKE SURVEYS.
N J Stat Ann sec 46:11-1 (1940).

Descriptors: *Surveys, *Surface drainage, *Land reclamation, *New Jersey, Swamps, Grasslands, Legislation, Statutes, Drainage programs, Legal aspects, Inspection, Judicial proceedings, Water law.
Identifiers: *Entry on land, *Rights of interested persons, *Limited access, *Right to drain land.

In any proceeding to lay out, alter, vacate or open a public road or street, or to determine possible encroachment upon or narrowing of such road or street by an adjacent landowner or possessor, and in any proceeding to enable the owner of swamp or meadow ground to drain that ground, and in any other proceeding touching a public improvement, any practical surveyor, with necessary assistants, who is employed by any person interested in any such proceeding, may enter on the adjacent lands or lands to be drained, or other lands, for the purpose of making necessary surveys, doing as little damage as possible. (Harris-Fla)
W69-03867

BAKER V NORMANOCH ASS'N, INC (OWNERSHIP OF LAKE BED).

25 N J 407, 136 A 2d 645-654 (1957).

Descriptors: *New Jersey, *Ownership of beds, *Tidal waters, *Public rights, Judicial decisions, Legal aspects, Lake beds, Easements, Littoral, Recreation, Riparian rights, Water law, Lakes.

Plaintiffs sought a declaratory judgment to determine whether as owners of property adjacent to a freshwater lake they have any right to recreational use of the lake. Plaintiffs acquired title to the land from the state but the grants reserved title to the lake bed and such title was subsequently conveyed to defendants. The lake was used by the general public and plaintiffs for several years before defendants objected to such use. The court held that plaintiffs had no right to use the lake. In New Jersey, inland bodies of water are either public or private. All tidal waters are public but the general public has no right to recreational use of private lakes. When land bordering upon a natural lake is conveyed, the grant extends only to the water's edge unless expressly stated otherwise. Plaintiffs were unable to show that the nature of their use necessary for the creation of an easement by prescription was adverse or hostile, to rebut the presumption that their use was permissive. (Molica-Fla)
W69-03898

LAUR V CITY OF MILWAUKEE (SURFACE WATER DRAINAGE).
1 Wisc 2d 561, 85 NW 2d 349-352 (1957).

Descriptors: *Surface waters, *Wisconsin, *Repulsion, *Common enemy doctrine, Legal aspects, Judicial decisions, Railroads, Prescriptive rights, Drainage, Culverts, Surface drainage, Flooding, Drainage water, Surface waters, Damages, Natural flow.

Plaintiff brought this action to restrain defendants from flooding his land and to seek an award of damages for past flooding. Plaintiff's land was separated from defendant's by a railroad right-of-way. The railroad had built a culvert through which surface water from plaintiff's land was carried off. The city, pursuant to an agreement with the defendant, filled in his low-lying land hampering the natural drainage of plaintiff's land and causing damage to it. Plaintiff claims that the ditch which drained his property had been adversely used by him for twenty years. Wisconsin adopts the common-enemy doctrine as applied to surface water; i.e. any proprietor may fight off or control as he will any surface water on his land, even if such actions cause damage to others. The court held that under state law the plaintiff had no cause of action for damages caused by the action or by changing the natural flow of water. The court held that there was insufficient evidence to show twenty years of adverse possession of the ditch by the plaintiff, and a directed verdict for the defendants was affirmed. (Shevin-Fla)
W69-03899

KERLEY V WOLFE (NAVIGABILITY OF LAKES).
349 Mich 350, 84 N W 2d 748-752 (1957).

Descriptors: *Michigan, *Riparian rights, *Navigable waters, *Public rights, Judicial decisions, Legal aspects, Recreation, Lakes, Riparian rights, Riparian lands, Boating, Fishing, Boundaries (Property).
Identifiers: Fences.

Adjacent land owners brought this action to force removal of a fence placed across a lake by a riparian landowner. Plaintiff and defendant are adjoining riparian owners. Defendant placed a fence at the neck of the lake to prevent passage of several boats from the upper end of the lake, where the plaintiff's land is located, into the main body of the lake. The plaintiff filed this bill to abate the fence and enjoin its maintenance. Defendant claims the vicinity of dispute is non-navigable and simply marsh land. The court found that the waters extending from plaintiff's premises to the deeper part of the lake were and are navigable in fact by small boats and the fence erected by the defendant interferes with the rights plaintiff possesses as a riparian owner. Whatever filling has taken place by nature's processes has not destroyed the navigable character of the upper end of the lake. When such part of the lake is navigable in fact, it is navigable in law. So long as boatable waters stand or flow in the upper reaches of the lake, people having lawful access to such waters may boat and fish in them. No upper or lower riparian owner may dispute passage by water of his riparian neighbor, when the stream or lake commonly enjoyed by all has been made navigable in fact by nature. (Shevin-Fla)
W69-03900

HEITSCH V CLARK (INJUNCTION TO ENJOIN CHANGE IN LAKE LEVEL).

346 Mich 381, 78 NW 2d 105-106 (1956).

Descriptors: *Michigan, Judicial decisions, Water law, Administrative agencies, Dams, *Legislation, Riparian land, Rivers, Riparian rights, Lakes, *Water levels, Reservoirs, *Drainage districts, Legal aspects, Remedies, Local governments.

Plaintiff landowners brought this suit in equity to enjoin the determination of a lake level behind a dam by the county drain commissioner. The trial court dismissed the complaint and dissolved the temporary injunction. The Supreme Court of Michigan, on appeal, affirmed the decision of the trial court holding that the plaintiffs should pursue their statutory remedy rather than invoking the aid of equity. The statute provided that interested persons may, at any time within five years after the lake level has been fixed by the drain commissioner, challenge the action in circuit court. (Watson-Fla)
W69-03901

BLACK MARSH DRAINAGE DISTRICT V ROWE (TAXATION FOR IMPROVEMENT OF DRAINAGE DISTRICT).
350 Mich 470, 87 N W 2d 65-69 (1957).

Descriptors: *Michigan, *Drainage Districts, *Public health, *Assessments, Cost, Project purposes, Depth, Administrative agencies, Legal aspects, Judicial decisions, Drainage, Tile drainage, Cities, Taxes.

This is an action by the drainage district against taxpayers for a declaratory decree that a drainage project was necessary. In 1955, two cities filed a petition for the improvement of the Black Marsh Drain. The Black Marsh Drainage Board had adopted a resolution determining that it had become necessary for the public health to tile said drain and make necessary changes in its depth. The defendants are taxpayers from each of the two cities protesting the assessment of the cost of the improvements against their respective properties. Witnesses testified that the improvement was necessary for the preservation of the health of the residents in the community. The court held that the drain project was necessary for the public health. (Shevin-Fla)
W69-03904

BRATONJA V CITY OF MILWAUKEE (ACTION TO RECOVER DAMAGES DUE TO FLOODING FROM HEAVY RAIN).
3 Wisc 2d 120, 87 N W 2d 775-780 (1958).

Descriptors: *Wisconsin, Judicial decisions, Surface runoff, Surface waters, *Sewers, Storm runoff, *Flood damage, Flood protection, Cloudbursts, Rain, *Rain water, Water law, Elevation, Local governments, Cities, Legal aspects, Damages, Drainage systems.
Identifiers: Negligence, Nuisance.

Plaintiffs owned buildings fronting on city streets. The area was within a natural saucer-like depression. A storm sewer in the area was laid in 1906. Improvements after that time mostly by the city, caused the level of the streets to be raised and soil by which rainfall would normally be absorbed to be covered. A relief sewer was later added. At least one plaintiff had suffered damages as a result of flooding due to a series of heavy rains. In 1949, another heavy rain fell, whereupon, several buildings in the area became flooded. Plaintiffs brought actions against the city, both on negligence and nuisance theories. The trial court found that there was no inadequacy or insufficiency in the original sewer plan, that the rainfall in 1949 was extraordinary, and that the city did not maintain the sewer system negligently. The appellate court affirmed, ruling that the city was under no obligation to collect the rainwater in the street; but if it actually took possession of such water and thereby assumed responsibility for it, it may have been liable for subsequently permitting it to escape on adjoining property. The plaintiffs failed to prove what part if any of their damage resulted from the backing up of the water in the sewer, contrasted with that from the flooding by surface water. The court held that attempting to label the condition a nuisance could not change the respective rights. (Wheeler-Fla)
W69-03905

COLLINS V WICKLAND (FLOOD DAMAGE DUE TO NATURAL DRAINAGE OBSTRUCTION).

88 N W 2d 83-88 (Minn 1958).

Descriptors: *Minnesota, *Watercourses (Legal), *Natural flow, *Drainage water, Judicial decisions, Water law, Flood damage, Surface runoff, Floodwater, Surface waters, Channels, Drainage, Unsteady flow, Legal aspects, Drainage systems, Channel flow, Damages, Land development, Land use, Reasonable use, Rainfall-runoff relationships.
Identifiers: Upper land owners, Lower land owners.

Plaintiff owned a city lot and building adjacent to defendant's lot. Before improvement of defendant's lot, draining water followed the contour of the land and formed a drainway on the land of both plaintiff and defendant. This channel had a maximum width of three feet and a maximum depth of nine inches. The flow through this channel from rains and melting snows was irregular and occassional. Defendant leveled his lot and used it as a parking lot. In so doing, the prior channel was eliminated, and the surface of his lot was raised above that of plaintiff, and an earthwall was created along plaintiff's lot. Defendant installed his own drainage system for his lot. After these changes, plaintiff's

land did not drain adequately. After heavy rainfalls, water backed up into plaintiff's basement, and stored equipment was damaged. Plaintiff brought suit for damages caused by the flooding. The trial court, in allowing recovery, applied the law governing natural water-courses, and held that defendant unlawfully obstructed natural flow. The appellate court reversed and granted a new trial, ruling that the correct law that should be applied for surface water was the reasonable-use doctrine. The court ruled that the minor, sporatic, surface water drainway did not constitute a natural watercourse. The court also held that any determination of the reasonable use of land requires a consideration of the normal use and development of land in the locality. (Wheeler-Fla)
W69-03906

LONG V EITNER HOMES, INC. (RIGHTS OF LAND OWNER TO CHANNEL SURFACE WATER ONTO ADJACENT LAND).

6 Bucks 91-107 (CP PA 1956).

Descriptors: *Pennsylvania, *Surface drainage, *Natural flow, *Diversion structures, *Alteration of flow, Judicial decisions, Ditches, Drainage, Surface runoff, Surface waters, Channel, Grading, Legal aspects, Watercourses.

Plaintiff owner of a tract of land sought to enjoin the former owner and developer of an adjoining upland tract from artificially altering and concentrating the flow of surface waters onto Plaintiff's land. The court held that defendant subdivider had the right to have surface water flowing on his property artificially altered and concentrated by the use of drains and to channel such water into a natural water course on adjoining land. It was held that an owner of land had the right to make proper and profitable use of his land even if this resulted in some change in the surface water flowing on to the adjoining lower land, provided such change did not divert the water from its natural water course on the adjoining land; resulted in no permanent change, diversion, or damage to the natural water course; and, did not unreasonably or unnecessarily change the quantity or quality of surface water on the abutting property. (Logan-Fla)
W69-03907

CLAIMS FOR DAMAGE GENERALLY ADJUSTMENT OF CLAIMS OF OWNERS OF PRIVATE DAMS.
N Y Canal Law secs 120, 121 (McKinney Supp Dec 1968), 2 p.

Descriptors: *New York, *Canals, *Damages, *Dams, Legislation, Accidents, Navigation, Appropriation, Waterways, Legal aspects, Impounded waters, State governments, Administrative agencies, Transportation.

Section 120 provides that every person shall be paid the amount of damages sustained from the canals or their use resulting from any accident of the negligence of any officer. The amount of the damages shall be ascertained by the court of claims and paid by the State, but only if the same evidence would create liability against an individual in court. The commissioner of transportation may make a settlement if it does not exceed $500. This provision does not apply to damages resulting from navigation. No payment for appropriation of land or water, or for damages will be made until the person demanding such damages produces a satisfactory abstract of title showing that he is legally entitled to them. Section 121 states that whenever the state utilizes private dams as essential parts of improvements to the canal system, the department of transportation may settle the claims of the owner and make provisions for the ownership of such dams provided no right or title to the use of any part or portion of water impounded by the dams is conveyed to the owners. (Shevin-Fla)
W69-03913

SEC 82 DEPOSIT OF REFUSE IN NAVIGABLE WATERS, SEC 81 SUPPLYING DEFICIENCIES OF WATER, SEC 83 SEIZURE OF OBSTRUCTION.
N Y Canal Law secs 81, 83 (McKinney Supp Dec 1968), 2 p; N Y Canal Law sec 82 (McKinney 1968), 1 p.

Descriptors: *New York, *Canals, *Wastes, *Water shortage, Legislation, Damages, Navigation, Obstruction to flow, Appropriation, Transportation, Legal aspects, Water supply, Sewage, Leases.

Section 82 states that it is unlawful to deposit any refuse in the canal system or any waters dredged at public expense and used for the canal system. A person violating the ordinance shall be responsible to the state for damages in the amount required to restore the waters to meet the needs of canal navigation. It is also unlawful to obstruct the navigation of a canal in any way. Section 81 provides that whenever there is a deficiency of water in any part of the canal system, the commissioner of transportation shall supply such deficiency by resuming use of surplus water leased, and, if the deficiency still exists, by using all water necessary to supply the deficiency. Damages shall be determined and paid by the state to people loosing their water rights. Under section 83, the commissioner may seize any object in the canal system not under the control of any person. Then he shall sell all objects at a public auction after posting notice unless the owner appears to claim the object and pay the expenses of removal. The Commissioner may remove any other object from the canal system that he deems is obstructing navigation and pay the owner appropriate damages. (Shevin-Fla)
W69-03914

DRAINAGE FACILITIES.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03917

GRANTS OF LANDS UNDERWATER.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03918

FLOOD PLAIN INFORMATION OF LEFT-HAND CREEK, VOLUME 1, BOULDER COUNTY, COLORADO.
Corps of Engineers, Omaha, Nebr.

Corps Eng Flood Plain Rep, Jan 1969. 24 p, 9 plate, 3 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Colorado, Maximum probable flood.
Identifiers: Left-Hand Creek (Colo), Boulder County (Colo), Standard Project flood, Intermediate regional flood.

Flooding of Left-Hand Creek, Boulder County, Colorado is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03926

FLOOD PLAIN INFORMATION, MOJAVE RIVER (VICINITY OF BARSTOW), SAN BERNARDINO COUNTY, CALIFORNIA.
Corps of Engineers, Los Angeles, Calif.

Corps Eng Flood Plain Rep, Oct 1968. 34 p, 17 fig, 49 plate, 7 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, California, Maximum probable flood.
Identifiers: Mojave River (Cal), Barstow (Cal), San Bernardino County (Cal), Intermediate regional flood, Standard project flood.

Flooding of the Mojave River near Barstow, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03927

FLOOD PLAIN INFORMATION, AUGLAIZE RIVER, WAPAKONETA, OHIO.
Corps of Engineers, Detroit, Mich.

Corps Eng Flood Plain Rep, May 1968. 37 p, 4 fig, 11 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Historic flood, Non-structural alternatives, Ohio, Maximum probable flood.
Identifiers: Wapakoneta (Ohio), Auglaize River (Ohio), Standard project flood, Intermediate regional flood.

Flooding of the Auglaize River, Wapakoneta, Ohio is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03928

FLOOD PLAIN INFORMATION, ALLEGHENY RIVER, LITTLE VALLEY AND GREAT VALLEY CREEKS, SALAMANCA, NEW YORK.
Corps of Engineers, Pittsburgh, Pa.

Corps Eng Flood Plain Rep, Sept 1968. 56 p, 12 fig, 16 plate, 14 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, New York, Maximum probable flood.
Identifiers: Allegheny River (NY), Little Valley Creek (NY), Great Valley Creek (NY), Standard Project flood, Intermediate regional flood.

Flooding of the Allegheny River, Little Valley Creek, and Great Valley Creek, Salamanca, New York is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03929

FLOOD PLAIN INFORMATION, OUACHITA RIVER, WEST MONROE, LOUISIANA.
Corps of Engineers, Vicksburg, Miss.

Corps Eng Flood Plain Rep, Nov 1968. 29 p, 13 fig, 10 plate, 6 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Maximum probable flood, Flood forecasting, River forecasting, Flood protection, Hydrograph analysis, Louisiana, Flood plain zoning, Historic flood.
Identifiers: Ouachita River, West Monroe, Louisiana.

Flooding of the Ouachita River flood plain at West Monroe is described in a report by the U.S. Army Corps of Engineers on the basis of the study of long-term records of runoff, rainfall, and other data observed since 1884. Maps, photographs, profiles, cross sections, and several plates (10) given in the report indicate the extent of flooding that has occurred and which may be expected to occur in the future. In general the report should be of value in planning ways to minimize the intensity of flood damage by using zoning and subdivision regulations, and by constructing flood-protections works. (V. Gabriel-USGS)
W69-03930

FLOOD PLAIN INFORMATION, CONCORD AND SHAWSHEEN RIVERS, BEDFORD, MASSACHUSETTS.
Corps of Engineers, Waltham, Mass.

Corps of Eng Flood Plain Rep, Sept 1968. 54 p, 3 fig, 12 plate, 8 tab, 3 append.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, Massachusetts, Maximum probable flood.
Identifiers: Concord River (Mass), Shawsheen River (Mass), Bedford (Mass), Intermediate regional flood, Standard project flood.

Flooding of the Concord and Shawsheen Rivers, Bedford, Massachusetts is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the constructions of flood protections works, or by combinations of these approaches. (Knapp-USGS)
W69-03931

FLOOD PLAIN INFORMATION-SOUTH FORK EEL RIVER, WEOTT TO MYERS FLAT, HUMBOLDT COUNTY, CALIFORNIA.
Corps of Engineers, San Francisco, Calif.

Corps'Eng Flood Plain Rep, June 1968. 38 p, 11 fig, 15 plate, 12 tab.

Descriptors: *Floods, *Flood damage, Flood plains, Flood control, Non-structural alternatives, California, Maximum probable flood.
Identifiers: Eel River (Cal), Humboldt County (Cal), Standard project flood, Intermediate regional flood.

Flooding of the South Fork Eel River, Humboldt County, California is described in a report of flood plain problems based on records of rainfall, runoff, and historical and present flood heights. Maps, photographs, profiles, and cross sections indicate the extent of flooding that has occurred and which may be expected to occur in the future. The information is for use in study and planning ways to minimize vulnerability to flood damages by control of flood plain use by zoning and subdivision regulations, the construction of flood protection works, or by combinations of these approaches. (Knapp-USGS)
W69-03932

SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
Herman Bouwer, and R. C. Rice.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6304, pp 481-492, Dec 1968. 7 fig, 2 tab, 2 ref.

Descriptors: *Seepage, *Infiltration, *Open channel flow, *Tracers, *On-site tests, Laboratory tests, Reservoirs, Canals, Irrigation.
Identifiers: Salt penetration, Seepage tracers.

Seepage rates in open channels or reservoirs are determined from the rate of salt penetration into the bottom material. A portion of the bottom is covered with crystals of a non-deflocculating salt. After dissolving, part of the salt enters the bottom with the seepage flow. The rate of advance of the peak of the resulting salt concentration 'wave' in the bottom material is measured with an electrical-conductivity probe. Laboratory studies showed that the seepage rate could be calculated by multiplying this salt penetration rate by the porosity of bottom material. A field study in a reservoir showed excellent agreement between the seepage obtained in this manner and the rate of fall of the water surface. The salt-penetration technique is simple and it can be carried out under a wide variety of canal conditions
W69-03935

CAROLINA BEACH FISHING PIER, INC V TOWN OF CAROLINA BEACH (STATE'S RIGHT TO TAKE PRIVATE BEACH LAND).

163 S E 2d 363-372 (N C 1968).

Descriptors: *North Carolina, *Eminent domain, *Water law, *Beach erosion, Judicial decisions, Legal aspects, Beaches, Sea walls, Landfills, Dredging.

Plaintiff brought action against defendant, a municipal corporation, for just compensation of land taken for a public purpose. Pursuant of Chapter 511 of North Carolina Session Laws of 1963 beaches that had eroded in Hanover County could be restored with sand and protected by construction of a seawall. Furthermore, any landowner affected by the provisions of the act could file a claim within six months after establishment and recording of a building line. The building line had to be filed within thirty days after completion of construction of the seawall. Defendant brought in fill to restore the beach on plaintiff's land, and filed a map of the building line on May 8, 1964, before beginning construction of the seawall. Plaintiff filed his suit May 19, 1965, over six months after defendant had filed the building line. Defendant completed construction of seawall in June, 1965. Defendant claimed the statute of limitations barred plaintiff's suit. The court held that plaintiff's suit was timely. It interpreted the statute in its entirety, saying the limitation period did not begin until thirty days after completion of construction. (Holt-Fla)
W69-03982

PROTECTION OF NAVIGABLE WATERS AND STREAMS; EXCAVATION OR FILL; DAMS AND DOCKS; PERMIT.
NY Conserv Law secs 429-b, 429-c (McKinney 1967) as amended and supp by NY Conserv Law sec 429-b (McKinney Supp 1968).

Descriptors: *New York, *Navigable waters, Water courses, *Obstruction to flow, Legislation, Excavation, Landfills, *Permits, Navigation, Barriers, Dams, Specifications, Administration, Control, Water law, Docks.

These sections require a permit in order to excavate or place fill in the navigable waters of the state or to erect or repair any dam, artificial obstruction, or structure used as a landing place in or across a natural stream or watercourse. Provision is made for the procedure of application and the standards which the Water Resources Commission uses in determining whether to grant or withhold such permit. Certain types of structures are exempted from the application of these sections. These sections are supplemented and sec 429b (1) is amended. (Childs-Fla)
W69-03984

GENERAL DUTIES - BOARDS OF RIVER REGULATING DISTRICTS.
NY Conserv Law sec 583 (McKinney 1967).

Descriptors: *New York, *Reservoir sites, *Flood control, Legislation, Rivers, Reservoirs, Maps, Specifications, Administrative agencies, *River regulation, Administrative decisions, Water law.

The board of the river regulating district may prepare a plan for the regulation of the flow of the rivers in its district. The plan is to show the available and feasible reservoir sites, the extent of land to be flowed by each reservoir and the ownership and value of such lands. Maps, profiles and other necessary data are to accompany the plan. The completed plan, if approved by the board of the river regulating district, is certified to the Water Resources Commission for its approval. After approval by the Water Resources Commission, the plan shall be known as the 'official plan' for the regulation of the flow of the rivers of the district. (Childs-Fla)
W69-03985

RIGHT OF ENTRY; UNLAWFUL INTERFERENCE WITH DRAINAGE WORKS.
NY Conserv Law secs 534,535 (McKinney 1967).

Descriptors: *New York, *Drainage programs, *Drainage district, *Easements, Legislation, Administrative agencies, Compensation, Condemnation, Real property, Legal aspects, Right of way, Taxes, Ditches, Water law.

The Water Resources Commission may enter upon any lands, structures or waters in order to carry out surveys and examinations required by Part 5, Article 5 to determine what rights in and to such property are to be acquired. If the owner of any property to be acquired or over which an easement is needed fails to agree with the Commission upon the compensation to be paid, the Commission shall proceed to take title thereto or the required rights, enter immediately and devote the property to public use. Notice must first be given and a deposit, as fixed by the court, must be made. A ditch or channel in use for at least 20 years is conclusive proof that a right of way and all other rights in the premises through which it passes were duly obtained. Real property acquired by a drainage improvement district is exempt from taxation. It is unlawful to interfere with drainage works, although construction of approved private drainage works is not prohibited. (Childs-Fla)
W69-03986

PROHIBITED DIVERSIONS.
NY Conserv Law sec 521 (McKinney 1967).

Descriptors: *New York, *Diversions, *Alteration of flow, Legislation, Jurisdiction, Administrative agencies, Administrative regulation, Legal aspects, Permits, Water law.
Identifiers: State waters.

The drawing, diversion or use of certain waters, after notice to desist has been given, is a misdemeanor punishable by fine. In addition, the Water Resources Commission may institute an action for the recovery of the sum of $50 per day for each day the prohibited activity continues. When the state has a proprietary right in the waters, the bed of such waters, or other real property necessary for the use of such waters; or if the waters are boundary waters of the state, this section shall apply. (Childs-Fla)
W69-03987

WASHINGTON GOLF AND COUNTRY CLUB V BRIGGS AND BRENNAN DEVELOPERS (ACTION FOR DAMAGE CAUSED BY FLOODING).

198 Va 586, 95 S E 2d 233-239 (1956).

Descriptors: *Virginia, Judicial decisions, *Flood damage, *Surface waters, Storm drains, Erosion, Legal aspects, *Damages.
Identifiers: Topographic change, Debris.

Plaintiff sued for injunctive relief and damages. It was alleged that defendant by changing the topography of his land, constructing roadways, and installing drains and storm sewers had caused the surface waters to collect in artificial channels diverting its natural flow. The result complained of was the discharge of this surface water in a materially augmented volume, mingled with silt and debris, upon plaintiff's golf course. Plaintiff appealed from a decree granting an injunction but failing to award damages. The court held that damages are not uncertain because they cannot be calculated exactly. One whose wrongful conduct has rendered difficult the ascertainment of precise damages cannot complain of their inexact measurement. The lower court decision was reversed with instructions to empanel a jury to decide the issue of damages. (Childs-Fla)
W69-03993

LAKE BARCROFT ESTATES V MCCAW (WATER DAMAGE DUE TO FLOODGATE OPENING).

93 S E 2d 124-126 (Va 1956).

Descriptors: *Virginia, *Floodgates, *Floods, *Dams, Judicial decisions, Flow control, Washouts, Damages, Flood damage, Rain, Sluices, Control structures, Reservoir operation, Legal aspects, Riparian rights, Riparian land.

William McCaw, a riparian owner, sued Barcroft Estates for damages to his real estate allegedly the result of the willful and deliberate opening of the flood gates on the defendant's dam during a heavy rainfall. The defendant admitted that the opening of the floodgates caused the damage, but denied that its employees had opened the gates. The defendant asserted that the gates opened automatically when the water rose as the result of the heavy rains. The circuit court found for the plaintiff and this court affirmed. The record disclosed that an employee of the defendant had manually opened the flood gates thereby releasing a far greater quantity of water on the lands below the dam than had accumulated in the reservoir as a result of the rains. Though the employee had opened the gates because he feared that the entire dam would washout if the water continued to accumulate, no evidence was introduced tending to establish the reasonableness of such fears. Since the defense counsel offered no objection to the testimony concerning the manual opening of the gates, the jury was free to believe whichever version seemed most reasonable. (Blunt-Fla)
W69-03995

HOUGH V OHIO RIVER SAND CO (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).
288 S W 2d 655-656 (Ct App Ky 1956).

Descriptors: *Kentucky, Judicial decisions, Rivers, *Ownership of beds, *Boundaries (Property), Damages, *Low water mark, Navigable waters, Boundary disputes, Land tenure, Beds.

Plaintiffs brought this action for damages and injunction on the ground that defendants dug sand on plaintiffs' submerged land causing the river banks along plaintiffs' lots to cave in. Plaintiffs' right to maintain this action depends on the ownership of the bed of the river. Defendants maintained that the boundary as expressed in plaintiffs' deed was to the 'low water mark,' which excluded the river bed. The court reached the opposite conclusion; that there is a presumption that the grantor intended to convey the bed of the stream as far toward the center as he owns. To rebut this presumption there must be a clear declaration of an intent to limit. Thus, the plaintiffs held to the thread of the stream. (Childs-Fla)
W69-03996

LEE-PHILLIPS DRAIN DIST V BEAVER BAYOU DRAIN DIST (UPPER OWNER'S RIGHT TO DRAIN WATERS ACROSS LOWER LAND CONDITIONED UPON PAYMENT FOR ANY IMPROVEMENTS NEEDED TO PROVIDE FOR HIGHER THAN NATURAL FLOW).
289 SW 2d 192-195 (Ark 1956).

Descriptors: *Arkansas, Judicial decisions, *Drainage districts, Surface drainage, Drainage systems, Drainage water, *Riddance (Legal aspects), Cost allocation, *Cost sharing, Separable costs, Canals, Legal aspects, Cleaning, Natural flow, Obstruction to flow, Relative rights.

Plaintiff lower drainage district sought to enjoin the defendant upper drainage district from improving its drainage canal until the plaintiff could improve its canal so as to safely carry the extra flow of water from the defendant's canal. The plaintiff also asked that the defendant district be compelled to share in the costs of improving the plaintiff's canal, or, failing that, to annex the plaintiff district's land in the canal area as part of the defendant's system. The defendant asserted that it had by purchase and prescription secured a permanent easement to discharge its waters into the plaintiff's canal. The defendant also stated that, since both canals were natural watercourses, it, as an upper owner, had a legal right to drain its waters into the canals of the plaintiff lower owner. The lower court granted an injunction against the defendant until it paid 93% of the cost of improving the plaintiff's canal: this court reversed and remanded. The defendant being an upper district, had a right to allow its natural flow of waters to follow the natural drain of the lower district's canal without obstruction. The lower district was responsible for the costs of providing for the natural drainage from the upper district, but the upper district was to pay any costs necessary to improve the plaintiff's canal to handle the extra flow of water as a result of the proposed improvements to upper district's land. (Blunt-Fla)
W69-03997

CLAUSS V BAUMGARTNER (AGREEMENT ON OWNERSHIP OF ACCRETIONS).
305 SW 2d 116-119 (Ark 1957).

Descriptors: *Arkansas, Judicial decisions, *Accretion, Riparian rights, Rivers, Riparian land, *Boundary disputes, Equitable apportionment, Land tenure, *Boundaries (Property), Riparian land.
Identifiers: Arkansas River, Rules of apportionment.

Adjacent riparian owners both claim accretions on the west bank of the Arkansas River. Pierce and Munn, previous owners of the land now owned by Clauss, had agreed with Baumgartner that the dividing of the accretion land would be the south line of Section 34 extended easterly to the river. It was agreed that this boundary line would extend to the southeast corner of Section 34 if the river added accretions for that distance. A fence was constructed along this line and the parties exercised acts of ownership on their lands divided by this division line. This evidence was held sufficient to sustain a finding that plaintiffs' predecessor in title had entered into a parole agreement with defendants as to the division line, which related to lands in existence and lands subsequently formed. (Childs-Fla)
W69-03998

ESSO STANDARD OIL CO V JONES (OWNERSHIP OF BED OF FORMER NAVIGABLE STREAM IS IN RIPARIAN OWNER).

98 So 2d 236-250 (La 1957).

Descriptors: *Louisiana, Judicial decisions, Royalties, Mississippi River, *Ownership of beds, Streambeds, Navigable waters, Oil wells, Low water mark, *Riparian rights, *Accretion, Legal aspects, Channels, Rivers.

A concursus proceeding was intitiated to determine the rights to royalties on oil taken from wells located on land formerly a part of the Mississippi river bed. The land was now above the rivers mean low water mark, the main course having changed following the cutting of a water control channel. The State of Louisiana claimed that since the oil wells are on land formerly the bed of a navigable stream, the land belonged to the state by right of sovereignty; and for this reason, the royalties belong to the state. The court held that the fact that an act of mankind had something to do with the change in the river channel did not prevent accretions to adjoining land from becoming the property of adjoining riparian owners. However, rights of accession are limited to lands abutting on a river or stream and have no application to lakes. But water does not have to flow continuously in order for a water course to be a river or stream. Thus, the riparian owners were held to be entitled to the oil royalties since the land had built up by successive and imperceptable accretions. (Childs-Fla)
W69-03999

EAST BATON ROUGE PARISH COUNCIL V KOLLER (NO OFFSET AGAINST DAMAGE AWARD FOR BENEFITS CONFERRED).
94 So 2d 505-507 (Ct App La 1957).

Descriptors: *Louisiana, Judicial decisions, *Drainage project, Damages, *Condemnation, Local governments, *Project benefits, Public benefits, Legal aspects, Excavation, Flood control, Drainage, Condemnation value.
Identifiers: Expropriation, Servitude.

Plaintiff appeals from an award to defendant landowner of $750 for a fifty-foot servitude for drainage purposes. Defendant's answer requesting an increase of the award to $1,100 was not filed until after oral argument and therefore could not be considered. The only two shade trees on the land would also be lost and plaintiff maintains that the award was erroneously arrived at because the trees were valued independently of the land. The court held that the valuation, considering the testimony, was of the land taken including the trees and while consequential damages such as loss of esthetic values are not per se compensable, they are properly considered if they diminish the value of the remaining property. The court also held that the damages awarded should not be offset by general benefits accruing, better drainage and less danger of flooding, because these are benefits which are shared by all property owners in the community. (Childs-Fla)
W69-04000

CITIZENS UTILITIES COMPANY V FEDERAL POWER COMMISSION (FPC JURISDICTION).

279 F 2d 1-3 (2d Cir 1960).

Descriptors: *Hydroelectric project licensing, *River flow, *Navigable rivers, *Dams, Legislation, Jurisdiction, Federal Power Act, Judicial decisions, Hydroelectric plants, Rivers, Diversion dams, Flow control, Impoundments, Public benefits, Water supply, Federal government, Administrative agencies, Administrative decisions.

The petitioner, a Delaware corp, built hydroelectric dams at several places on the Clyde River, Vermont. The occasion of this suit is the petitioner's construction of a new project including a diversion

dam, a canal, and a power plan across the river below the dam at the outlet of Clyde Pond. The Federal Power Commission (FPC) began to investigate this partially completed power project in order to determine whether it was in the public interest to control it in order to preserve the navigation and the water supply of the Clyde River. The FPC determined that not only the Clyde Pond project, but also the petitioner's other projects affected the navigability of the river; and thus the petitioner was required to apply for a license. The court held that the evidence was sufficient to prove that the dams even at nonnavigable points on the river are, at the will of the petitioner, capable of affecting temporarily the flow of water in the navigable portion of the river below Clyde Pond. The court affirmed the order of the FPC requiring an application for a license as required by section 817 of Title 16, USCA. (Smith-Fla)
W69-04002

HUNT LAND HOLDING COMPANY V SCHRAMM (PRESCRIPTIVE RIGHTS).
121 So 2d 697-701 (2d DCA Fla 1960).

Descriptors: *Florida, *Ditches, *Surface drainage, *Prescriptive rights, Judicial decisions, Easements, Dams, Surface water, Drainage, Culverts, Water law, Artificial watercourses, Natural streams.

A mandatory injunction sought by and granted to the plaintiffs in the suit below required the defendants to remove a dam which they had constructed across an outfall drainage ditch. The ditch was constructed by persons unknown and had provided drainage for surrounding lands in excess of 45 years. It had through the years been used without objection by anyone concerned and all had acquiesced in its use. The road department constructed drainage ditches west and east of US 1, which connect with the drainage ditch here involved. The road department periodically cleaned the ditch and maintained it from the time US 1 was constructed to the time of the instant suit. The appeal was advanced upon the sole proposition that there was no proof of an adverse use and hence there could be created no easement by prescription. The court affired the trial court's ruling and held that the use was so continuous and notorious as to impute to the owners of the lands that the claimants were exercising their privilege under a claim of right adverse to the owners for the required period of 20 years. (Smith-Fla)
W69-04003

JONES V HOME BUILDING AND LOAN ASS'N OF THOMASVILLE (LOWER OWNER'S OBSTRUCTION OF UNDERGROUND FLOW).
114 SE 2d 638-648 (NC 1960).

Descriptors: North Carolina, Judicial decisions, *Underground streams, *Percolating waters, Water sources, *Obstruction to flow, Barriers, *Natural flow doctrine, Relative rights, Damages, Cracking, Flood damage, Deflection, Channels, Watercourses (Legal), Legal aspects.

Plaintiffs' basement was continually flooded allegedly due to an underground basement on defendant's adjoining lower lot. The plaintiffs contended that the concrete walls of the basement obstructed the flow of a subterranean stream and forced water up through the floor of the plaintiffs' basement. The defendants contended that there was no evidence showing the existence of a subterranean stream in the area and appealed a jury verdict for the plaintiffs. This court vacated the judgment of the lower court and ordered a new trial to determine whether the defendant had negligently obstructed percolating waters. Plaintiffs' evidence was insufficient to raise a jury submissible issue as to whether the waters obstructed constituted a subterranean stream. All underground waters are presumed to be percolating, and the burden is on the plaintiffs to prove otherwise. The plaintiffs had to establish the presence of a stream or body of water flowing in fixed or definite channels, the location of which is known or ascertainable by men of ordinary powers from surface indications or other means without excavations for that purpose. The rights and liabilities with respect to subterranean streams, unlike percolating waters, are generally governed by the rules of law applied to surface streams. A person who obstructs a known subterranean stream known with reasonable certainty that he will break the natural flow, and the obstruction is therefore, intentional. A person who obstructs the flow of percolating waters usually has no certain knowledge what the consequences will be and can only be liable on the ground of negligence should harm result. (Blunt-Fla)
W69-04004

THE LAW OF WATER IN NEW JERSEY,
Rutgers - The State Univ., New Brunswick, N. J.
Eva Morreale Hanks.
Rutgers Law Review Vol 22, No 4, Summer 1968, pp 621-715. 94 p. OWRR-14-01-0001-594, OWRR Project A-001-NJ.

Descriptors: *Riparian rights, *New Jersey, *Water rights, *Legal aspects, Judicial decisions, Natural flow doctrine, Reasonable use, Repulsion (Legal aspects).

This study deals with riparian rights in surface watercourses and the law governing diffused surface water. New Jersey has, in the past, been categorized by most authors and commentators as a riparian state, committed to the doctrine of natural flow. That doctrine says that owners of riparian land are entitled to the flow of the water in surface water-courses in its natural state, undiminished in quantity and quality. This picture of New Jersey water law is inaccurate. New Jersey is a true natural flow doctrine state in only one respect, namely, in regard to the so called 'merchandising' of water. That is, an abstraction of water for purposes of sale and use in connection with non-riparian land is per se unlawful. If the controversy, on the other hand, centers around the use of water or riparian land or involves conduct allegedly leading to pollution of the source, the appropriate standard by which to judge the defendant's behavior is that of reasonableness. The infliction or noninfliction of injury on the plaintiff is an element of judging the reasonableness of the defendant's behavior. The rule of reason also applies to drainage. (Whipple-Rutgers)
W69-04055

VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMIC PROGRAMMING,
Massachusetts Inst. of Tech., Cambridge, Mass.
Douglas Albert Haith.
M S Thesis, Massachusetts Institute of Technology, Dept Civil Eng, Aug 1966. 75 p, 29 fig, 3 ref, 1 append.

Descriptors: *Dynamic programming, Sewers, Constraints, Pipelines, Economic efficiency, *Drainage systems, *Design, Computer programs, Network design, Water conveyance, Hydraulic design, Hydraulic gradient.

A design procedure based on the principles of dynamic programming was presented for the analysis of vertical alignment of open channels. The design of conduits as a special case of open channels was developed in detail. The objective was to find the optimum (least cost) solution given the elevation of pipe at the beginning and end of the line. The effect on cost of a constraint against decreasing downstream pipe diameters was investigated, and the analysis was extended to the design of simple branched networks. The Computer program for determining pipeline construction costs and performing the dynamic programming was presented. Several examples were analyzed using this program. (Gysi-Cornell)
W69-04150

CARD V NICKERSON (ACTION FOR DAMAGES FOR OBSTRUCTION OF NATURAL WATER COURSE).
104 A 2d 427-431 (Me 1954).

Descriptors: *Maine, *Watercourse (Legal), *Obstruction to flow, *Judicial decisions, Natural flow, Flow, Landfills, Channel flow, Channels, Backwater, Damages, Rock fill dams, Abatement, Streamflow, Drainage systems, Drains, Pipes.
Identifiers: Nuisance.

Water flowed through a natural watercourse from plaintiff's land to and through adjoining land of defendant, which he had purchased from plaintiff, and then into a pond and brook. The watercourse was well-defined and rarely dry. Defendant filled in part of the course on his property and installed inadequate drains, with the result that water backed up onto plaintiff's land. Plaintiff brought an action for damages. The trial court gave judgment to plaintiff and excluded evidence that defendant told plaintiff, prior to the execution of the deed, that he planned to cause the fill. The jury was allowed to base the award upon permanent damage. The appellate court reversed, holding it proper to exclude the parole evidence about the warning, but ruling it error for the award to have been given for permanent damage. The court said permanent damage to real estate cannot be recovered in such nuisance cases where the cause may be abated or removed. (Wheeler-Fla)
W69-04151

PUBLIC UTILITIES COMMISSION.

Me Rev Stat Ann tit 35, secs 9, 11-14 (1965).

Descriptors: *Maine, *Project planning, *Public utilities, *Water resources development, Legislation, Water storage, Water resources, Dams, Dam construction, Basins, Reservoir storage, Watershed management, Regulation, Geological surveys, Legal aspects.

The Public Utilities Commission is directed to collect information relating to the State's: (1) water resources, (2) river flow and drainage area, (3) lakes, in regard to their capacity as storage reservoirs, and other data to enable the Commission to devise methods for improving the natural storage basins of the State and to provide for new reservoirs. The Commission may cooperate with the United States Geological Survey in the preparation of hydrologic and geological surveys. Anyone proposing to erect or develop a water storage basin must file a statement and plan with the Commission. The Commission's biennial report shall contain an account of operations. The report may also include (1) data pertaining to the water powers and resources of the State, (2) plans for the improvement and creation of water storage basins. Anyone proposing to construct a new water system must file a plan and specifications therefor. Ice or debris in the bed of any stream above tidewater which may cause property damage may be removed with the permission and under the direction of the Commission. (Molica-Fla)
W69-04160

PARTICULAR NUISANCES.
Me Rev Stat Ann tit 17, sec 2802 (Supp 1968-69).

Descriptors: *Maine, *Nuisance, *Wells, *Water pollution, Legislation, Shafts, Excavations, Navigable waters, Navigation, Obstruction to flow, Barriers, Stream pollution, Diversion, Alteration of flow, Natural flow doctrine, Routing, Riparian rights, Diversion structures, Legal aspects.
Identifiers: *Public nuisance.

This statute declares certain acts to be public nuisance. Such acts include the following: permitting abandoned wells to remain uncovered; obstructing, without legal authority, the passage way of any navigable water; corrupting or polluting the waters of a river, stream, or pond, and; finally, unlawfully diverting water from its natural course or

state to the injury or prejudice of others. (Stewart-Fla)
W69-04161

HOPSON V DOWNS (OBSTRUCTION TO NATURAL FLOW OF SURFACE WATER).

340 S W 2d 475-478 (Ct App Ky 1960).

Descriptors: *Kentucky, *Civil law, *Natural flow doctrine, *Drainage, Remedies, Adjudication procedure, Surface drainage, Floods, Legal aspects, Relative rights, Surface runoff.
Identifiers: Negligence.

The owner of upper land brought an action against a lower owner for damage caused by water which backed up behind a fill constructed on the lower land. An injunction against the lower owner was also sought. The Circuit Court found for the defendant and plaintiff appealed. Kentucky follows the civil law rule that a lower owner has no right to create any obstruction to the natural flow of surface water from upper to lower land. The only issue that should have been submitted to the jury was whether defendant's fill caused flooding of plaintiff's land. Here the case was submitted under theory of negligence in construction of fill. The plaintiff upper owner offered an instruction embodying negligence as the basis of liability, so he could not complain of error. The plaintiff was not entitled to an injunction when the jury determined that the lower owners had committed no wrongful act. (Kahle-Fla)
W69-04172

NEMETH V COUNTY OF GENESEE (ACTION FOR CROP DAMAGE FROM ENLARGEMENT OF DRAINAGE DITCH).

347 Mich 65, 78 NW 2d 634-640 (1956).

Descriptors: *Michigan, *Drainage systems, *Flooding, *Culverts, Judicial decisions, Water law, Damages, Drains, Outlet works, Pipes, Roads, Surface drainage, Drainage, Ditches, Drainage effects, Drainage engineering, Drainage water, Administrative agencies, Drainage districts, Surface runoff, Flood damage.
Identifiers: Negligence.

Plaintiffs brought action against the drain commissioner and county to recover for crop damages. They alleged that the damage resulted form the enlargement of a drainage ditch traversing their land without corresponding enlargement of the culvert into which the drain waters flowed. The lower court held for the defendants, and the Supreme Court of Michigan affirmed holding that the evidence sustained the finding that the plaintiffs had not been damaged because of any breach of duty on the part of the defendants. The Supreme Court stated that the drain commissioner had a duty to exercise ordinary care and judgment in the discharge of his duties, but he was not an insurer of any particular project and would not be liable for a mere mistake in judgment. Furthermore, the evidence did not prove that the enlargement of the drainage ditch caused the damage. The court also stated that it is a matter of common knowledge that low, flat land with surface depressions, as involved in the present case, presents difficulties with reference to drainage. (R H Watson-Fla)
W69-04175

CITY OF MERIDIAN V NEW ORLEANS AND NORTHEASTERN RR (INADEQUATE DRAINAGE THROUGH CULVERTS).

291 F Supp 303-307 (SD Miss 1968).

Descriptors: *Mississippi, *Culverts, *Flooding, *Engineers estimates, Judicial decisions, Legal aspects, Floods, Backwater, Cities, Railroad, Bridges, Rivers, River flow, Flood control, Obstruction to flow, Rainfall, Drains.
Identifiers: Trestles.

Defendant's railroad track, on an open wooden trestle, crossed a stream located within the limits of plaintiff city. In 1955, defendant installed metal culverts under the trestle's trackbed and filled in the area between the culverts. Plaintiff sought to have defendant remove the culverts which allegedly caused flooding at this point and other points upstream because of the inadequacy of the culverts to handle the flow during periods of heavy rain. Evidence showed that flooding had occurred before as well as after the changes. However, the flowage capacity of the culverts was less than adequate according to engineering studies. The court held that the plaintiff had a cause of action because the city has a duty to maintain bridges and roads affected by flooding and it may abate a nuisance. The defendant has a duty not to impair the flow of the creek and the court directed defendant to make such changes at the crossing as would be required to meet reasonable forseeable floods. (Molica-Fla)
W69-04176

KUSHNER V PAZ CONSTR (STORM SEWER DRAINAGE).

171 NYS 2d 1007-1009 (S Ct 1958).

Descriptors: *New York, *Easements, *Storm drains, *Obstruction to flow, Legal aspects, Judicial decisions, Manholes, Sewers, Drainage water, Flooding, Surface runoff, Natural flow, Relative rights.

Plaintiff sold the westerly portion of her parcel of land to the defendant. A storm sewer ran along the rear of both parcels and water in it naturally flowed in a westerly direction. The deed did not reserve an easement for the storm sewer in plaintiff's favor. To stop the flooding of his land due to a blockage of the sewer to the west of him, the defendant filled in a manhole located on his property. This caused a flooding of plaintiff's cellar. The court held that plaintiff was not entitled to a temporary injunction to compel the defendant to remove the obstruction and that an easement for sewer drainage over defendant's land would not be implied by law. (Molica-Fla)
W69-04179

FELSON V ASPEGREN (TO ENJOIN DIVERSION OF ARTIFICIAL STREAM AND CREATION OF ARTIFICIAL POND).
178 NYS 2d 679-681 (S C 1958).

Descriptors: *New York, *Riparian rights, *Artificial watercourses, *Ponds, Judicial decisions, Water law, Drainage water, Natural streams, Drainage systems, Surface runoff, Tiles, Drainage, Streams, Damages, Legal aspects, Diversion, Alteration of flow.

Plaintiff sought injunctive relief to prohibit the diversion of waters from an artificial stream which flowed through his land. The Supreme Court of Westchester County held that the relief could not be granted because the golf course, upon which the stream was created and the diversion occurred, was not joined as a defendant. The court further stated, however, that the plaintiff had no riparian or proprietary rights in regard to the stream because it was not a natural watercourse. The injunction was granted, however, to prohibit the creation of an artificial pond on the defendant's land from the diverted water. The water from the pond seeped and overflowed onto the plaintiff's adjoining property. Damages were not awarded because the relief granted would restore the property value. (Watson-Fla)
W69-04180

KOSSOFF V RATHGEB-WALSH (ACTION FOR DAMAGE CAUSED BY SURFACE WATER FLOW).
3 NY 2d 583, 170 NYS 2d 789-795 (Ct App NY 1958).

Descriptors: *New York, *Surface waters, *Natural flow, *Reasonable use, Relative rights, Judicial decisions, Surface runoff, Runoff, Surface drainage, Drainage water, Overland flow, Prescriptive rights, Damages, Seepage, Flow, Gravitational water, Land development, Elevation, Legal aspects.
Identifiers: Upper landowner, Lower landowner.

Plaintiff owned land on a slope below and abutting defendant's unimproved lot. While defendant's land was still unimproved, a store was built on plaintiff's land. Defendant later built a gas station, which involved a slight raising of the level of his lot where it adjoined plaintiff's land. No pipes, ditches, or other artificial drains were employed by defendant. After these changes, surface water from defendant's lot seeped through the wall of plaintiff's building and caused damage. Plaintiff brought suit to recover damages, contending that defendant's improvements caused an increase of flow, and that once changes of the natural state were made, he was required to take preventive measures to protect the lower land. The trial judge dismissed the complaint, ruling that defendants had the right to make reasonable improvements, even though the effect was to increase the flow to plaintiff's land. The appellate court affirmed using the common law approach that either owner may improve his land according to his own desire in any manner to which the land is suited, without being liable to the abutting owner for change in surface water flow, provided he does not use drains, pipes, or ditches. The court further stated that the fact that one lot was improved first gave no cause for a prescriptive right. (Wheeler-Fla)
W69-04181

DRAINAGE OF AGRICULTURAL LANDS; PROCEDURE.

NY Conserv Law sec 575 (McKinney 1963).

Descriptors: *New York, *Swamps, *Condemnation, *Land reclamation, Legislation, Bogs, Lakes, Land, Ditches, Easements, Maps, Surveys, Assessments, Damages, Administrative decisions, Administrative agencies, Land resources, Drains.

Any person owning a swamp or other low or wet agricultural lands, who wishes to drain them in order to make the land more productive and deems it necessary that a drain be constructed or maintained on the lands of others, may condemn an easement pursuant to the Condemnation Law. If he has been unable to agree with the other owner as to damages, he may file a petition with the Commission. He must present the names of the owners of the land to be occupied and appropriate maps and surveys. The Commission will undertake investigation to determine the validity of the request. The Commission must notify all interested parties as to the date and location of the hearing. The Commission can view the premises and determine the necessity of the drainage; and, if it finds the action necessary, it shall assess the damages. Both the petitioner and the owner may review the findings of the Commission. (Shevin-Fla)
W69-04185

RIVER REGULATION BY STORAGE RESERVOIRS - DEFINITIONS AND CONSTRUCTION.
NY Conserv Law secs 580 (1) (2) (11) (12) (13) (McKinney 1967).

Descriptors: *New York, *River regulation, *Reservoir storage, *Regulated flow, Legislation, Land, Lakes, Ponds, Streams, Riparian rights, Dams, Easements, Basin, Rivers, Bridges, Sluices, High water mark, Low water mark, Public health.
Identifiers: *Real estate.

Real estate includes all lands above and below water, the waters of any lake, pond, or stream, all riparian rights, water powers, dams and every estate in land or water acquired or used for railroad, highway, or other public purpose. The 'regu-

lating reservoir' is a basin for impounding all waters formed or enlarged by a dam or any other barrier or structure which cannot be removed without causing damage. All lands under water impounded and whatever other lands may be necessary to preserve the sanitary condition of the reservoir are included within the term 'regulating reservoir.' The high flow line is the line which will be made around the reservoir by water at the level of the crest of the reservoir spillway. The low flow line is made by the water of the reservoir at its lowest level. Unsanitary condition or conditions mean such condition or conditions as are a menace to public health. (Shevin-Fla)
W69-04186

CREATION OF RIVER REGULATION DISTRICTS.

NY Conserv Law sec 581 (1) (McKinney 1967).

Descriptors: *New York, *River regulation, *Reservoir operation, *Public health, Legislation, Streams, Reservoir construction, Water control, Assessments, Taxation, Eminent domain, Administrative agencies, Legal aspects.
Identifiers: *River regulating districts, Public welfare.

River regulating districts may be created to maintain and operate reservoirs for the purpose of regulating the flow of streams, when required by the public welfare, including public health. Such districts are declared to be public corporations and shall have perpetual existence and the power to acquire such real estate and other property as may be necessary, to sue and be sued, to incur contract liabilities, to exercise the right of eminent domain and of assessment and taxation, and to do all acts and exercise all powers authorized by this title. Such powers shall be exercised by and in the name of the board of the district. (Shevin-Fla)
W69-04187

MANCINI V DELILLIS (ACTION TO REQUIRE REMOVAL OF DITCH OBSTRUCTION).

65 A 2d 90-92 (Super Ct N J 1948).

Descriptors: *New Jersey, *Surface runoff, *Ditches, *Obstruction to flow, Drainage, Water conveyance, Diversion structures, Drainage water, Judicial decisions, Surface drainage, Drainage systems, Artificial watercourses, Natural flow, Watercourses (Legal), Surface waters, Damages, Drainage effects.

Plaintiff and defendant both owned produce farms in the same low-land area. Drainage of excess water from rains and melting snows was accomplished by a series of ditches. For at least fifty years, a main ditch carried water from plaintiff's property, through land of his adjoining neighbor, and then through defendant's property. Defendant blocked the main ditch at a point where it passed through defendant's land in order to divert the water into a secondary ditch. However, due to a difference in evaluation of the outlets of the two ditches, the water level of the main ditch was raised. Plaintiff brought this action to require the removal of the obstruction, alleging that plaintiff's land became unusable as a farm for lack of proper drainage. The court gave judgment for plaintiff, upholding prior New Jersey cases which held that no one has a right to obstruct or divert water which has flowed in the same course for more than twenty years, regardless of whether it involved a natural water course or an artificial ditch. (Wheeler-Fla)
W69-04194

4B. Groundwater Management

LAND SUBSIDENCE IN PLEASANT VALLEY AREA, FRESNO COUNTY, CALIF.,
Bureau of Reclamation, Sacramento, Calif.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03797

OFFENHARTZ V HEINSOHN (EASEMENT TO ALLOW UNDERGROUND TRANSPORT OF WATER).

150 N Y S 2d 78-86 (S C 1956).

Descriptors: *Easements, *Water conveyance, *Closed conduit flow, Reservoir, Springs, Right-of-way, Damages, New York, Legal aspects.

Plaintiff sued to enjoin interference with conveyance of water beneath defendant's land from springs to a reservoir on plaintiff's land. Plaintiff's deed purported to grant an easement on defendant's property with rights to transport water under it via pipes and conduits. When defendant subsequently purchased the land between the springs and plaintiff's property from a third party, the deed she took acknowledged no easement in plaintiff's favor. The court found no adverse possession by plaintiff, although water from the spring had been transferred by means of gravity flow through the conduits to plaintiff's reservoir for 15 years (while defendant was in possession) prior to this action. The court held that underground transfer of water to the reservoir could have established an easement only if it was done with defendant's knowledge and permission. (Kelly-Fla)
W69-03908

GEOLOGY AND GROUNDWATER RESOURCES OF LARAMIE COUNTY, WYOMING,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 03F.
For abstract, see .
W69-03979

DIGIACINTO V NEW JERSEY ZINC CO (LANDOWNER'S RIGHTS TO TAKE PERCOLATING WATER).

Lehigh L J 307-317 (C P Lehigh County Pa 1957).

Descriptors: *Pennsylvania, *Percolating water, *Mining, *Grouting, Judicial decisions, Drilling, Wells, Domestic water, Domestic use, Groundwater, Pumping, Legal aspects, Underground streams, Damages.
Identifiers: Trespass, Correlative rights doctrine.

Plaintiff brought action in trespass against defendant to recover damages to property allegedly caused by defendant's pumping operations. Both parties owned land in the same township. Plaintiff obtained his domestic water supply from a well. Defendant, a mine operator, pumped water from the ground in an effort to lower the water table so as to make mining operations feasible. The defendant admitted that his mining operations were responsible for plaintiff's well going dry. The court held for defendant, saying that underground water is presumed to be percolating water unless such presumption is rebutted by competent evidence. If a landowner destroys his neighbor's percolating water supply through lawful purposes carried out on owner's land without malice, there is no liability for such destruction. In order to prove malice, it must be shown that the owner had knowledge of the injury inflicted upon his neighbor and that his activities must stem from a motive other than legal and economic use. The court adopted the absolute ownership rule and failed to recognize the correlative rights doctrine as applied to groundwater. (Holt-Fla)
W69-04038

4C. Effects on Water OF Man's Non-Water Activities

EFFECTS OF URBAN DEVELOPMENT ON FLOODS IN NORTHERN VIRGINIA,
Geological Survey, Richmond, Va.
Daniel G. Anderson.
Geol Surv open-file rep, 1968. 26 p, 5 fig, 5 tab, 9 ref.

Descriptors: *Floods, *Urbanization, *Virginia, *Flood routing, Drainage systems, Storm runoff, Hydrographs, Hydrograph analysis, Routing, Forecasting, Time lag.
Identifiers: Urban hydrology, Urban floods.

Graphical and mathematical relations are presented to estimate the flood peak magnitudes having recurrence intervals ranging up to 100 yr for drainage basins with various degrees of urban or suburban development. Five independent variables are required for use of the relations. They are basin size, length, and slope which may be measured from maps, and percentage of impervious surface and type of drainage system which may be evaluated by a basin inspection, but which in actual practice will usually be estimated for future developed conditions. The estimating relations are based upon analysis of flood information for 81 sites, 59 of which are in the Washington, D. C., metropolitan area. The relations are judged to be of adequate accuracy for design of drainage systems and for definition of flood limits. Urban and suburban development are shown to significantly affect flood flows. Improvements to the drainage system may reduce the lag time to one-eighth that of the natural channels. This lag time reduction, combined with an increased storm runoff resulting from impervious surfaces, increases the flood peaks by a factor that ranges from 2 to nearly 8. The flood-peak increase depends upon the drainage basin characteristics and the flood-recurrence interval. (Knapp-USGS)
W69-03706

STRICKLAND V STATE (DISCHARGE OF SURFACE WATER - STATE'S LIABILITY FOR NEGLIGENT INDEPENDENT CONTRACTOR).

177 NYS 2d 983-989 (Ct Cl 1958).

Descriptors: *New York, *Surface waters, *Road construction, *Flood damage, Highways, Surface drainage, Surface runoff, Erosion, Rainfall, Rainfall-runoff relationships, Rainfall intensity.
Identifiers: Debris.

Plaintiff owned property located on a 10% grade ascending to a highway. The State employed a contractor to resurface the highway and install gutters and culverts. Plaintiff's property was damaged when a heavy, but not unprecedented, rain fell in the area and washed large amounts of dirt, stones, and debris onto his land. The State's contractor had failed to cover the gutters with concrete, as was specified in the contract plans, thus leaving loose gravel and other material susceptible to erosion. The court found such omission to be negligence and the proximate cause of plaintiff's injury. However, the State was not liable since it and the contractor were not in the relationship of 'master and servant' or 'principal and agent.' An employer is not liable for the torts of an independent contractor unless: (1) the employer is independently negligent; (2) the employer is negligent in hiring the contractor; (3) the legislature otherwise provides; (4) the employer ratifies, adopts, or concurs in the tort; or (5) the work is inherently dangerous. (Bozarth-Fla)
W69-03820

IN RE SHIPPINGTON FERRY CO (RIGHTS OF FERRY OWNER AGAINST STATE FOR FRANCHISE INFRINGEMENTS).

247 A 2d 466-467 (Pa 1968).

Descriptors: Judicial decisions, *Legal aspects, *Eminent domain, Bridges, *Pennsylvania, *Ohio River, Water law, Bridge construction, State governments.
Identifiers: Franchise, Ferry.

Appellant, Shippingport Ferry Company, claimed damages against the State due to the construction of a bridge across the Ohio River. The court said that appellant had no action against State either under an eminent domain theory or a property damage theory. The franchise granted to appellant neither assured it of continued patronage nor the only means of traversing the river. The State did not impinge upon, appropriate, or extinguish the franchise it granted appellant prior to the bridge construction. (Holt-Fla)
W69-03903

SEC 40 ACQUISITION OF PROPERTY - SEC 43 EXCHANGE OF PROPERTY.

N Y Canal Law secs 40, 43 (McKinney Supp 1968), 8 p.

Descriptors: *New York, *Appropriation, *Canals, *New York State barge canal system, Legislation, Transportation, Surveys, Streams, Lakes, Highways, Rights-of-way, Easement, Navigation, Legal aspects, Easements, Administrative agencies, Maps.

Section 40 provides that the acquisition of property for use by the canal system will be by appropriation by the commissioner of transportation. All lands are subject to appropriation regardless of the interest retained in the land. After a map of the land is prepared and filed with the Attorney-general, the commissioner must file a notice of appropriation directed at the owners of the land with the county clerk. Each owner must be served personally. Commissioner may cause the owner to be removed from the land, make settlements of claims for damages, and make arrangements for payment of moving expenses. The State will be liable for any damages incurred in the maintenance of the canal system. All costs will be appropriated from the commissioner's office. The commissioner acquires streams, lakes, streets, roads, highways and rights-of-way. When the use of acquired property is no longer needed, the easement right may terminate and the property vest back to the owner. Under section 43 payment for property acquired may be made by exchange of property no longer needed in the barge canal system. The properties should be of equal value. The land to be exchanged must first officially be declared to be abandoned and then the Commissioner may obtain a quit-claim deed to effectuate such exchange. (Shevin-Fla)
W69-03915

DISPOSITION OF STATE UNDERWATER LANDS.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03919

WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
Aarhus Univ. (Denmark). Inst. of Economic and Applied Geography.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-03949

PEOPLE AND WATER,
Oregon State Univ., Corvallis, Oreg. Water Resources Inst.
Charles A. DeDeurwaerder, Thomas C. Hogg, Arnold M. Westling, DeWitt Nelson, and Raymond C. Vars.
Proc Water Resources Res Inst Seminar, Spring Quarter 1968, Oregon State Univ., July 1968. Total 109 p, 16 fig, 4 tab. Funds for publication supplied by OWRR, Dept of Interior.

Descriptors: *Water resources development, *Social aspects, *Urban sociology, *Water requirements, Legal aspects, Water rights, Aesthetics, Recreation, Population, Social function, Social needs, Water demand, Industries, Economics, Floods, Flood plains.
Identifiers: Willamette Basin (Ore), Flood plain use, Urban hydrology.

The relations of people to water, particularly of urban people, industry, and urban areas to rivers, are discussed in the record, a series of weekly seminars held at Oregon State University, Spring 1968. The individual seminar topics are: water as a determinant of urban form; social and cultural impact of water development; people and water at the local level; interpreting water resources problems; income redistribution through project design; rights of the public and water use; recreational demand; flood plain occupance; and the Willamette Basin study. All the seminars are primarily social in emphasis, stressing legal aspects, urban development, and water rights, and do not involve water as a strictly physical resource problem. (Knapp-USGS)
W69-03953

WATERFRONT RENEWAL.
Wisconsin Dept. of Resource Development.

Wisconsin, Department of Resource Development, Madison, 1966, 68 p, 5 map, 71 photo, 17 dwg.

Descriptors: *Methodology, *Local governments, *Wisconsin, Harbors, Transportation, Land use, Efficiencies, Storms, Shoreline protection, Water quality, Public benefits, Multiple purpose, Aesthetics, Education, Legal aspects.
Identifiers: *Urban waterfront renewal, *Waterfront deterioration, Shoreline structures, Upland benefits, Municipal responsibilities.

The first chapter discusses urban waterfront problems and classifies the typical causes of waterfront blight. Main types of causes include changing port use, changing land transportation, deteriorating shoreline structures, natural factors, and change in waterfront land use. The second chapter discusses the need for urban waterfront planning and lists necessary objectives of any urban waterfront renewal plan. These goals include transportation efficiency, reducing storm damage, insuring shoreline maintenance, improving surface water quality, increasing public use, increasing upland benefits, and creating multiple use of waterfront land. Discussed are means of developing the great esthetic potential of waterfront areas and described are the wide range of possible uses of a waterfront. Chapter III lists methods by which local governments can avert or overcome waterfront deterioration. Possible activities include encouraging orderly transitions in waterfront land use, education of riparian owners and the public enforcement of codes requiring maintenance of waterfront structures, municipal improvement of its own share of the waterfront, selective clearance of structures, and total clearance and redevelopment. Several renewal projects which have taken these actions are illustrated. The chapter ends with a description of renewal proposals for selected Wisconsin waterfronts. (Gossen-Chicago)
W69-04033

CITY OF HUNTSVILLE V MILLER (MUNICIPAL WATER).

127 So 2d 606-611 (Ala 1958).

Descriptors: *Municipal water, *Surface waters, *Drainage effects, *Alabama, Drainage, Municipalities, Drainage systems, Damages, Ditches, Rain water, Sewers, Water works, Controlled drainage, Adjudication procedure, Judicial decisions, Legal aspects, Discharge (Water).

Plaintiffs, owners of land adjacent to water collection facilities of the City of Huntsville, filed a bill in equity against the city seeking to enjoin as a nuisance the collection of surface waters in the vicinity of plaintiffs' lands and the depositing of such waters thereon. The plaintiffs also sought damages to the lands resulting therefrom. The trial court denied injunctive relief but awarded damages. The Alabama Supreme Court never reached the merits of the case in holding that the equity court, after denying all equitable relief, could not retain jurisdiction to grant damages at law. The Alabama Supreme Court held void the decree purporting to award damages and dismissed the appeal. On rehearing the issue was whether the maintenance by the city of an already existing system for the drainage of surface waters which caused injury or damage to another's land was subject to abatement in equity. The court relying on case law, held negatively and denied rehearing. (Carruthers-Fla)
W69-04166

4D. Watershed Protection

HYDROLOGY OF CORNFIELD WASH AREA AND EFFECTS OF LAND-TREATMENT PRACTICES, SANDOVAL COUNTY, NEW MEXISO, 1951-60,
Geological Survey, Washington, D. C.
D. E. Burkham.
Geol Surv Water-Supply Pap 1831, 1967. 87 p, 25 fig, 1 plate, 13 tab, 33 ref.

Descriptors: *Erosion control, Sediment control, Land management, Precipitation intensity, Runoff, Sedimentation, Evaporation, New Mexico.
Identifiers: *Cornfield Wash Basin, *Land treatment.

To reduce and control erosion, keep sediment at its source, and rehabilitate damaged land, a 10-yr program was initiated in the Cornfield Wash basin. Data acquired indicate that precipitation averaged 6.07 in. for the warm season, and that from 1951 to 1955 much of the precipitation came in short torrential downpours. The total composite inflow to the 19 reservoirs in this basin was 5,720 acre-ft, and the original total storage capacity of the 19 reservoirs was reduced from 845 to 455 acre-ft as a result of the impoundment of 390 acre-ft of sediment. Reservoir backwater accounted for an additional 20 acre-ft of sediment. By inducing sediment accretion upstream, the reservoirs are effective; also, they impede abrupt headcuts downstream as long as the spillage is slight and the spillway stays intact. These reservoirs also effectively reduce flood peaks. (Llaveria-USGS)
W69-03747

PROCEEDINGS: INTERNATIONAL SYMPOSIUM ON FOREST HYDROLOGY.
National Science Foundation, Washington, D. C.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03806

PROJECTS TO PREVENT SHORE EROSION.

NY Unconsol Laws secs 1531, 1532, 1534, 1535, 1536, 1537, 1538, 1539 (McKinney Supp Dec 1968), 5 p; NY Unconsol Laws sec 1533 (McKinney 1966) 2 p.

Descriptors: *New York, *Shore protection, *Beach erosion, *Erosion control, Legislation, Cities, Shores, Projects, Administrative agencies, Check structures, Damages, Embankments, Taxes, Federal project policy, Ownership of beds, Construction costs, Cost allocation, Bulkheads, Maintenance, Maintenance costs.

The commissioner of conservation is authorized to construct bulkheads, groins, jetties, fills and other works upon non-privately owned land in order to arrest erosion and protect against storms. The construction cost includes the cost of preparing plans, specification and engineering services. The municipalities affected shall reimburse the state for fifty percent of the construction costs. Upon completion the municipalities affected shall have ownership of the improvements and shall bear the

maintenance expense. The state is not liable for any damages resulting from such improvements. The state may make grants to municipalities of submerged lands to carry out the purpose of this act. The provisions of this act shall not apply to projects undertaken by the federal government. The act provides for acceptance of federal funds for projects authorized by the state but limits the states contribution to the amount appropriated for the project. One million dollars is appropriated to pay the states share. (Childs-Fla)
W69-04183

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification OF Pollutants

INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio; and Oklahoma State Univ., Stillwater. School of Civil Engineering.
For primary bibliographic entry see Field 07B.
For abstract, see .
W69-03744

DETERMINATION OF STRONTIUM-90 IN WATER,
Geological Survey, Washington, D. C.
J. O. Johnson, and K. W. Edwards.
Geol Surv Water-Supply Pap 1696-E, 1967. 10 p, 2 fig, 4 ref.

Descriptors: *Radiochemical analysis, *Analytical techniques, Strontium radioisotopes, Water quality, Water chemistry, Fallout, Pollutants, Water pollution sources.
Identifiers: *Strontium-90 analysis.

A method is described for the determination of strontium-90 in waters free of strontium-89, or for determination of gross radiostrontium activity as strontium-90. The method is suitable for use on natural water samples and other aqueous systems in the absence of high concentrations of organic substances which form stable complexes with strontium. The minimum detection limit at the 95% confidence level is 0.55 picocuries/l for the recommended 500-ml sample. (Knapp-USGS)
W69-03749

GAS CHROMATOGRAPHIC ANALYSIS OF DALAPON IN WATER,
Agricultural Research Service, Denver, Colo.; and Bureau of Reclamation, Denver, Colo.
P. A. Frank, and R. J. Demint.
Environ Sci Technol, Vol 3, No 1, pp 68-71, Jan 1969. 3 p, 4 fig, 1 tab, 4 ref.

Descriptors: *Chemical analysis, *Chromatography, Water analysis, *Gas chromatography, *Separation techniques, Solvents, Analytical techniques, Solvent extractions, *Dalapon, Herbicides, Pesticides, Chlorinated hydrocarbon pesticides, *Pesticide residues, Ethers.

Several methods for analyzing 2,2-dichloropropionic acid (dalapon) residues have been reported. These methods require a great deal of time and lack the sensitivity required for most present-day residue analysis. An efficient and sensitive procedure for extraction and analysis of dalapon in water is described. Acidified and NaCl-saturated samples containing dalapon are extracted with diethyl ether. After partitioning the extract through bicarbonate and back to ether, dalapon is converted to its methyl ester. Electron-capture gas chromatography is used for the analysis. Recoveries of dalapon from water averaged 96%; the minimum level of detection was 0.1 ng. This rapid, reliable, and highly sensitive method was developed for analyzing dalapon in water, but should be adaptable for analyzing dalapon in soils and water. (USBR)
W69-03755

RADIOACTIVE WASTE DILUTION IN THE CLINCH RIVER, EASTERN TENNESSEE,
Geological Survey, Washington, D. C.
P. H. Carrigan, Jr.
Geol Surv Prof Pap 433-G, pp G1-G9, 1968. 9 p, 10 fig, 15 ref.

Descriptors: *Path of pollutants, *Radioactive wastes, *Waste dilution, *Tennessee River, Tennessee, Turbulence, Reservoirs.
Identifiers: Clinch River (Tenn), Oak Ridge National Laboratory, Tennessee Valley Authority.

A convenient, direct measure of simple volumetric dilution of low-level radioactive liquid wastes released from the Oak Ridge National Laboratory by waters of the Clinch River has been defined. This measure of dilution is called the dilution factor. The dilution factor is the ratio of flow in the Clinch River to flow of the radioactive liquid waste stream (Whiteoak Creek) for concurrent periods of time. Dilution characteristics of the Clinch River and Whiteoak Creek have been described by means of several types of statistical analyses: central tendencies, extremes, cumulative frequency distribution, seasonal trends, and magnitude-duration-frequency curves of minimum dilution factors. In order to apply results of these statistical analyses, complete and steady mixing of the waters of the Clinch River and Whiteoak Creek must be assumed. Exploratory diffusion tests indicate that complete mixing in the cross section has occurred within a reasonable distance downstream from the mouth of Whiteoak Creek. Flows in the Clinch River in the vicinity of Whiteoak Creek have been affected considerably by releases from Norris Lake for peak-demand hydroelectric power. Other exploratory tests indicate that the effects of the variation in flow of the Clinch River were almost completely evened out through processes of turbulent diffusion. (USGS)
W69-03956

5B. Sources of Pollution

CONTAMINANTS IN GROUNDWATERS NEAR WASTE STABILIZATION PONDS,
Cincinnati Univ., Ohio. Dept. of Civil Engineering.
H. C. Preul.
J Water Pollut Contr Federation, Vol 40, No 4, pp 659-669, Apr 1968. 11 p, 5 fig, 2 tab, 13 ref.

Descriptors: *Groundwater, *Path of pollutants, Alkylbenzene sulfonates, Ammonia, Phosphates, Nitrification, Soils, Minnesota, Stabilization, Biodegradation.
Identifiers: *Groundwater contamination, Stabilization ponds.

Field observations were made over a 3-yr period on nutrient concentrations found in groundwaters near 10 waste stabilization lagoons in Minnesota which treat domestic wastewater from small municipalities. Subsurface soils were sandy or silty, and the ponds had high percolation rates. The nitrogen in pond percolation waters was mainly in the form of ammonia; nitrification did not appear to occur significantly. Ammonia nitrogen concentrations were largely depleted within about 200 ft (60 m) of a pond, with the decrease apparently due to adsorption. Phosphates were not found in significant concentrations in the groundwaters; they are adsorbed by soils over a wide pH range. Alkyl benzene sulfonate was found in the range of 0.5 mg/l as far as 200 ft (60 m) from a pond, which may be true of other organics resistent to biodegradation.
W69-03718

STATISTICAL APPROACH TO ESTUARINE BEHAVIOR,
Federal Water Pollution Control Administration, Washington, D. C.; and Kansas City, Mo.
T. A. Wastler, and Carl M. Walter.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6311, pp 1175-1194, Dec 1968. 20 p, 5 fig, 7 tab, 6 ref, append.

Descriptors: *Estuaries, *Density stratification, *South Carolina, *Statistical methods, *Time series analysis, Estimating, Salinity, Stratification, Water pollution, Path of pollutants.
Identifiers: *Charleston Harbor (SC), Spectral analysis.

Data analysis techniques used in a study of Charleston Harbor, South Carolina, show how spectral analysis can be used to characterize hydraulic interactions within the estuary. The technique was used to establish the water quality and hydraulic patterns existing during the field study period and to predict future water quality and hydraulic structure under conditions of greatly reduced river inflow. Methods of calculating cross-spectra and associated statistics are presented, and the use of these techniques in carrying out the data analysis is shown. Results of the study show that very strong vertical stratification exists at high river discharges, and that the stratification breaks up as river discharge decreases. (Knapp-USGS)
W69-03732

IDENTIFICATION OF PETROLEUM IN ESTUARINE WATERS,
California State Dept. of Public Health, Berkeley.
Claude Z. Maehler, and Arnold E. Greenberg.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA5, Pap 6172, pp 969-978, Oct 1968. 10 p, 8 fig, 8 ref.

Descriptors: *Pollutant identification, *Water pollution, *Estuaries, *Oil, *Analytical techniques, Water pollution sources, Pollutants, Chromatography, Sampling, Gas chromatography, Spectrophotometry.
Identifiers: Infrared spectrophotometry.

The increased concern about spills of petroleum products in the estuarine environment has brought about increased demands for analytical methods equal to the task of identifying pollutants and their possible sources. A number of qualitative comparative procedures have been described which permit the clear recognition of petroleum products in water. These procedures are capable of demonstrating characteristics of petroleum materials peculiar to individual lots but analysis should generally include several of the techniques. They are therefore useful in comparing oil spills with reference samples. A simple sequential scheme is presented which includes gas chromatographic analysis of vapor space gas and solvent extraction followed by infrared spectrophotometric and paper chromatographic examinations.
W69-03738

AMMONIA NITROGEN LOSSES FROM STREAMS,
San Diego State Coll., Calif. Dept. of Civil Engineering.
Frank E. Stratton.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6282, pp 1085-1092, Dec 1968. 8 p, 2 fig, 4 tab, 7 ref. Grant NSF-GK-1623.

Descriptors: *Nitrogen cycle, *Aeration, *Streams, *Turbulent flow, Sanitary engineering, Water quality, Temperature, Reduction (Chemical), Photosynthesis, Vegetation effects, Waste water disposal.
Identifiers: *Ammonia nitrogen losses, *Stream turbulence.

Results of studies of gaseous ammonia nitrogen losses caused by stream turbulence are presented and the potential significance of such losses in reducing fertilization of downstream receiving

waters is given. In describing the experimental procedure a graphic plot is shown of measured ammonia concentration versus time; tables show the rate constants for ammonia nitrogen loss, comparison of temperature effects of rate constants, pH effects on rate constant, and flow times and distances needed to effect 50% reduction in ammonia nitrogen concentration at various temperature and pH values. Since algae can raise the pH of streamwaters during active photosynthesis periods, small shallow streams with vegetal growths can loose large quantities of ammonia nitrogen to the atmosphere. (Lang-USGS)
W69-03745

OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.

N J Stat Ann secs 23: 9-108 to 23: 9-112 (1940).

Descriptors: *Legislation, *New Jersey, *oil industry, *Industrial plants, Fish, Bays, State jurisdiction, Boats, Oil wastes, Legal aspects, Fishing, Flow control, Water pollution, Water pollution sources.
Identifiers: *Raritan bay, *Sandy Hook Bay, Debris, Penalties.

These sections deal with oil factories in Raritan and Sandy Hook Bays. Section 108 states that no person shall, for the purpose of pressing or obtaining oil from fish in these waters or any of the tributaries thereof: (a) Erect a floating factory, or (b) place on board a vessel with intent to use machinery for such purpose. Section 109 forbids the flow into these waters of any soap, pumice, debris, residuum or refuse matter arising from the pressing or manufacturing of oil from fish. Section 110 provides that a vessel or floating erection of any kind found on these waters carrying machinery and materials for manufacturing oil from fish will be forfeited to the state. Section 111 makes violation of these provisions a misdemeanor and punishable by fine of $200, or imprisonment at hard labor not exceeding one year, or both. Section 112 allows the informer to receive one-half of any fine and forfeiture recovered; the other one-half being paid to the state treasure. (Heckerling-Fla)
W69-03848

CORRUPTING WATERS FORBIDDEN.

Me Rev Stat Ann tit 38, sec 571 (1965).

Descriptors: *Legislation, *Maine, *Water pollution, *Contamination (Water), Toxins, Nuisance (Water law), Wells, Springs, Lakes, Ponds, Public health, Rivers, Reservoirs, Water supply, Ice, Legal aspects, Pollutants.
Identifiers: Poisoning, Penalties (Criminal).

This section provides that whoever knowingly and willfully poisons, defiles, or in any way corrupts the waters of any well, spring, brook, lake, pond, river, or reservoir used for domestic purposes by man or beast; or whoever knowingly corrupts the sources of any public water supply, or the tributaries of said sources of supply, in such manner as to affect the purity of the water so supplied; or whoever knowingly defiles such water in any manner, whether the same be frozen or not, or puts the carcass of any dead animal or other offensive material in said waters or upon the ice thereof, shall be punished by a fine of not more than $5000 or by imprisonment for any term of years. (Heckerling-Fla)
W69-03863

BLOOD V CITY OF NEW YORK (ACTION TO RECOVER DAMAGES FROM TURBIDITY ALLEGEDLY CAUSED BY DAM).

237 F 2d 855-856 (2d Cir 1956).

Descriptors: *New York, *Turbidity, *Dam construction, *Downstream, Impaired water quality, Judicial decisions, Dams, Damages, Mud, Legal aspects, Physical properties, Opacity, Suspension, Rivers, Delaware River, Riparian rights.

Plaintiff owned resort properties on the Delaware River, downstream from the confluence of the Delaware and Neversink Rivers, and about forty-five miles below the dam constructed by defendant. Plaintiff brought suit to recover damages on the ground that the dam caused river water, as it passed by the resort, to be turbid and muddy. Plaintiff alleged the dam violated his rights as a property owner and interfered with his business. Plaintiff conceded that the defendant had a right to build the dam. The lower court gave judgment to defendant, primarily due to the insufficiency of evidence introduced by plaintiff. The appellate court affirmed, ruling that the trial judge's decision was not clearly erroneous. (Wheeler-Fla)
W69-03909

HOWARD V ATLANTIC COAST LINE RR (ACTION FOR DROWNING IN ABANDONED WELL).
231 F 2d 592-595 (5th Cir 1956).

Descriptors: *Florida, *Bodies of water, *Drowning, *Shallow wells, Risks, Judicial decisions, Wells, Legal aspects, Swimming, Safety, Railroads, Water sources, Water wells.
Identifiers: Abandoned wells, Negligence, Attractive nuisance.

Defendant railroad company had dug a well to furnish water for steam locomotives. The well, located on posted railroad property, was twenty feet by twenty feet, and had been abandoned. Railroad employees placed boards over the well to prevent it from being used. However, children removed the boards and began to use the well as a swimming hole. Efforts by the railroad to replace the boards and order the children off the property failed. A few days prior to when the well was to be filled, a young boy slipped into the well and drowned. The boy's mother brought action for the death of her son. The trial judge entered a judgment for defendant notwithstanding a jury verdict for plaintiff. The appellate court affirmed, ruling that the owner of an artificial body of water is not guilty of actionable negligence for drownings therein unless it is so constructed as to constitute a trap or unless there is some unusual element of danger lurking about it not existent in ponds generally. The court held that the steep sides of the well did not constitute sufficient hidden danger, and that the facts did not warrant a finding of an attractive nuisance. (Wheeler-Fla)
W69-03924

WATER POLLUTION IN THE GREAT LAKES BASIN,
Federal Water Pollution Control Administration, Great Lakes Region, Chicago, Ill.
H. W. Poston.
Limnos, Vol 1, No 1, pp 6-11, Spring 1968. 6 p, 6 photo.

Descriptors: *Great Lakes, *Water pollution, *Water pollution control, Water pollution effects, Eutrophication, Fishkill, Algae, Oxygen sag, Water quality, Chlorides, Phosphorus, Sulfates, Hardness (Water).
Identifiers: Great Lakes basin, Bacterial pollution.

The causes of water pollution of the Great Lakes basin, presently available remedies, and recommendations for action in pollution control are discussed. The Lakes, particularly Lake Erie, are becoming eutrophic because of waste discharges. Tertiary treatment with phosphorus removal will alleviate the problem and also reduce biochemical oxygen demand. Chlorides, sulfates, and hardness are increasing. Bacterial pollution is a serious problem in tributaries, and in local zones in the Great Lakes near population centers where recreational demand is also highest. Elimination of combined sewers as well as better sewage treatment will help. Chemical contamination caused by industrial waste disposal is widespread. Oxygen levels are low in streams, small lakes, and the central basin of Lake Erie. An unusual form of pollution is the over-population of alewives in Lake Michigan. Periodic fishkills litter the shore. One of the main difficulties in solving Great Lakes problems is diversity and need for coordination of government agencies in the basin. Creation of the water quality standards and the Great Lakes Basin Commission should help. (Knapp-USGS)
W69-03948

PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
Massachusetts Univ., Amherst.
C. W. Miller, H. B. Gunner, and B. M. Zuckerman.
Water Resources Res Center Proj Completion Rep, Dec 1968. 14 p. 14-01-0001-1389, OWRR Project A-019C-MASS Originally A-010-MASS.

Descriptors: *Pesticide residues, *Plants, *Soils, *Water, *Biodegradation, Pesticide kinetics, Adsorption, Distribution patterns, Leaching, Pesticide toxicity.
Identifiers: Pesticide degradation.

Parathion was detected in young bean leaflets 2 hr following its application to soil. Uptake continued for 24 hr following soil application, but slowed considerably after the first 6 hr. Most if not all the parathion molecule remained intact within the plant after 22 hr. Younger leaflets accumulated higher concentrations than older leaflets. No parathion was detected in root exudates 24 hr after foliar application. Sucking insects did not die after being exposed to leaves 24 hr after soil application. Water samples were taken from a stream running through a cranberry bog treated by helicopter with parathion at a rate of 1 lb/acre. Samples taken from the surface and from 15 inches below the surface were taken at 2-hr intervals for 24 hr, 900 feet downstream. In surface water, parathion was detected in large quantities after 2 hr (0.124 ppm), and decreased sharply after 6 hr (0.42 ppb). Residues 15 in. below the surface varied from 11.2 ppb immediately after application to 0.5 ppb 10 hr after application. Samples of impounded water, taken 1 in. below the surface contained 214 ppb of parathion. After 4 hr the detectable amounts of parathion decreased to 5.03 ppb and the parathion content remained fairly constant for another 14-16 hr. (Knapp-USGS)
W69-03962

PROCEEDINGS BEFORE THE COMMISSIONER (LEGAL ACTION AGAINST SOURCES OF POLLUTION).

N Y Pub Health Law sec 1242 (McKinney Supp 1968).

Descriptors: *New York, *Water pollution sources, *Sewage disposal, *Bodies of water, Water pollution control, Industrial wastes, Sewers, Legal aspects, Legislation, Administrative agencies, Regulation, Sewage, Public health, Water law, Water pollution, Disposal, Effluents, Sewage effluents, Investigation.

The Commissioner shall investigate any alleged act of pollution of any waters of the State. If the Commissioner discovers wastes being discharged into the waters of the state, or into sewers which ultimately empty into the waters of the state, he shall notify the persons responsible for the discharge to answer charges against them at a hearing; which hearing shall be held at least twenty days after such notice is served. The accused shall file an answer to the charges with the Commissioner along with a statement of any measures being taken to prevent the discharge of pollutants into the waters of the state. The burden of proof with respect to violations is on the Commissioner. After the hearing, the Commissioner shall enter a final order and shall advise the accused of the substance of such order. There is an emergency provision whereby the Com-

missioner, if he deems such discharge of sewage dangerous to the health of the people, may inform the person responsible that he must discontinue such discharge immediately. (Sisserson-Fla)
W69-03989

VIOLATION; INJUNCTION AND ABATEMENT (WATER POLLUTION SOURCES).
N Y Pub Health Law sec 1102 (McKinney 1954).

Descriptors: *New York, *Water pollution, *Potable water, Legislation, Administrative agencies, Administrative regulation, Cities, Water supply, Legal aspects, Regulation, Inspection.
Identifiers: Board of health.

When an inspection discloses a temporary or permanent source or act of contamination, notice of such violation of regulations shall be served on the person responsible. If there is not compliance, an examination shall be held. If it is found that a violation has in fact occurred, the board of health is to enforce compliance. The commissioner of water supply, gas and electricity of New York or the board of water supply may summarily enforce compliance with the regulations and may summarily abate or remove the cause of the violation. The City of New York is entitled to maintain an action for the recovery of the penalties incurred by such violation and for an injunction restraining the person from violating the regulation. This section is annotated. (Childs-Fla)
W69-03991

AN ACT TO REPEAL SECTIONS 204.030, 204.100, AND 204.170, RSMo 1959, RELATING TO WATER POLLUTION AND TO ENACT IN LIEU THEREOF FOUR NEW SECTIONS, RELATING TO THE SAME SUBJECT, WITH PENALTY PROVISIONS.

Mo Laws H 319 (Aug 7, 1967).

Descriptors: *Missouri, Legislation, Permits, Pollution abatement, *Water pollution control, Water pollution sources, Industrial wastes, Organic wastes, Sewage, Abatement, Regulation, Damages, *Costs, Discharge, Disposal, *Water pollution.
Identifiers: Injunction.

It is unlawful for any person to cause pollution as defined in Mo Rev Stat sec 204.010 (1959), and it is declared that such pollution constitutes a public nuisance that may be forcibly abated by the county at the property owner's expenxe. It is unlawful to construct or modify a disposal system for industrial or sewage wastes without first securing a permit from the county board. The board can require the submission of plans, specifications and other information to aid it in deciding whether a permit will be issued. It shall be the board's function to determine whether the discharge will cause pollution contrary to the public interest. The board may investigate any apparent violation and may, after public hearing, revoke or modify the permit of anyone found to be violating its orders. The board must furnish the permit holder thirty days notice of its intent to revoke or modify said permit. County prosecuting attorney may apply to any court of competent jurisdiction for an injunction to restrain violation of this law. Any person violating this law may be fined not less than $25 nor more than $500.00 and/or be imprisoned for no more than 90 days. Each day on which a violation occurs shall constitute a separate offense. In addition to the above penalties, the state or its subdivisions has a cause of action in tort for actual damages against any person violating this section. Mo Rev Stat secs 204.030, 204.100, and 204.170 (1959) are repealed by the addition of this legislation. (Blunt-Fla)
W69-04007

DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
Clemson Univ., S. C.
Benjamin C. Dysart, III, and William W. Hines.
Water Resources Center, Georgia Institute of Technology, WRC-0668, January 1969. 195 p, 46 fig, 11 tab, 48 ref, 2 append. OWRR Project A-012-Ga.

Descriptors: *Water quality control, Dissolved oxygen, Water temperature, Georgia, Systems analysis, *Mathematical models, *Simulation-analysis, Reaeration, Waste assimilative capacity, Biochemical oxygen demand, Streamflow, Waste treatment, *Organic wastes, *Thermal wastes, Water quality standards, Decision making, Methodology.
Identifiers: Chattahoochee River, Atlanta (Georgia).

Methodology for water quality planning and management which considers interacting wastes in a stream has been developed and demonstrated. The methodology demonstrates a procedure for minimizing the total abatement cost for thermal and organic wastes in a river basin while satisfying multiple stream standards. The pollutants used in the studies were heat and BOD. A generalized stream was modeled as an N-stage serial system, with principal waste outfalls, major tributaries, changes in standards, etc., constituting stage boundaries. Initial-value, two-dimensional dynamic programming was used to optimize the system and determine the minimum-cost abatement policy which allowed specific standards to be attained. The Chattahoochee River basin was used to illustrate the methodology. The river was modeled as a four-stage serial system. Optimal policies as to abatement of thermal and organic wastes were determined for a wide range of (a) streamflow, (b) deoxygenation coefficient, (c) reaeration coefficient, and water quality standards (DO, maximum temperature, and allowable temperature rise). Although limited by the quality and consistency of input data, the methodology developed would provide considerable aid to persons and agencies in planning and management of water quality.
W69-04017

NITRATE AND OTHER WATER POLLUTANTS UNDER FIELDS AND FEEDLOTS,
Agricultural Research Service, Fort Collins, Colo. Soil and Water Conservation Research Div.
B. A. Stewart, F. G. Viets, Jr., G. L. Hutchinson, and W. D. Kemper.
Environ Sci Technol, Vol 1, No 9, pp 736-739, Sept 1967. 2 fig, 1 tab, 1 ref.

Descriptors: *Nitrate, *Pollutants, *Agricultural watersheds, Nitrogen compounds, Feedlots, Groundwaters, Water pollution, Eutrophication.

The effect of agriculture on nitrate pollution of groundwater was investigated in the South Platte Valley of Colorado. Nitrate-nitrogen was determined in core profiles of land under various kinds of use. Nitrate was highest under feedlots; however, indications are that irrigated lands are contributing more total nitrate to the groundwater (the ratio of irrigated land to that in feedlots for the study area was approximately 200:1). Average nitrate-nitrogen levels ranged from 70 kg/ha under alfalfa to 1282 kg/ha under feedlots. Groundwater samples often contained high concentrations of nitrate, and those obtained beneath feedlots contained nitrite-nitrogen and organic carbon. Because feedlots are usually located near homesteads, further concern about the effect of feedlots on underground water supplies arises. (Konrad-Wis)
W69-04024

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
Delaware River Basin Commission, Trenton, N. J.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04039

POLLUTION.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04050

DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
Texas A and M Univ., College Station. Water Resources Inst.
Roy W. Hann, Jr.
Technical Report No 17, Feb 1969. 57 p. OWRR Project A-004-Tex.

Descriptors: *Water quality, *Estuaries, Simulation, *Optimization, Reservoir management, Economic analysis.

Several analytical models which were obtained and modified for use in evaluating water resource problems are described. A method for evaluating the optimum blend of water from two or more reservoirs to meet several concurrent quality criteria is presented. The special importance of estuarine analysis methods relating to water quality is outlined and two models are presented one for a steady state dispersion of wastes in partially mixed estuaries and the other an optimization scheme using linear systems analysis to determine the optimum waste loads into an estuarine system under a variety of constraints. Interbasin transfer of water is examined and one plan evaluated to demonstrate the use of analytical models for streamflow evaluation, field determination and reservoir simulation. The use of a Leontif input-output model to predict economic growth as a function of resource use is developed and an example presented using the area affected by the Blackburn Crossing Reservoir in East Central Texas.
W69-04133

INFLUENCE OF FATTY ALCOHOLS AND ACIDS ON THE CLARITY AND BIOTA OF IMPOUNDED RESERVOIRS,
Texas A and M Univ., College Station. Water Resources Inst.
William B. Davis, and Tom D. Reynolds.
Technical Report No. 18, Feb 1969. 76 p, 9 tab, 33 fig. OWRR Project A-003-Tex.

Descriptors: Evaporation control, Monolayer films, *Oxygen diffusion, *Ecology, Oxygen deficiency, *Hexadecanol, *Octadecanol.

This project presents results on a laboratory and field investigation of some of the biological and physical effects as a result of the use of a 1:1 mixture of hexadecanol and octadecanol. Laboratory investigations were concerned with changes in pH, hardness, alkalinity, turbidity, surface clarity, oxygen diffusion, diurnal oxygen, chlorophyll, bacterial counts, some unicellular algae, some filamentous algae, waterweeds (Anacharis) and fish (Gambusia affins and Fundalus notatus).LD AND LABORATORY INVESTIGATIONS WERE ALSO CONCERNED WITH THE DERIVATION AND EXPERIMENTAL VALIDATION OF AN EXPRESSION TO GIVE THE DISSOLVED OXYGEN CONCENTRATION DURING THE CRITICAL NIGHT PERIOD FOR A SMALL LAKE OR POND TREATED WITH A +:1 mixture of hexadecanol and octadecanol.
W69-04134

UNLAWFUL DISPOSAL OR TAKING OF BALLAST.
Me Rev Stat Ann tit 38, sec 124 (1965).

Descriptors: *Legislation, *Maine, *Boats, Admiralty, Flotsam, Jettsam, Water pollution, Highway beautification, Community development, Harbors, Islands, Beaches, Legal aspects.
Identifiers: *Ballast, Penalties (Criminal).

This section provides that no master of any vessel shall throw overboard ballast in any road, port or harbor, under penalty of $60, and no person shall take any stone or other ballast from any island, beach or other land, without consent of the owner, under a penalty of not more than $7 for each of-

fense, to be recovered in a civil action by any prosector, 1/2 for himself and 1/2 for the town where the offense is committed. (Heckerling-Fla)
W69-04158

LITTERING AND DUMPING.

Me Rev Stat Ann tit 17, sec 2251 (Supp 1968-69).

Descriptors: *Maine, *Garbage dumps, *Waste disposal, *Domestic wastes, Legislation, Garbage, Recreation facilities, Recreation wastes, Public lands, Parks, Refuse, Tidalwaters, Inland waters, Navigable waters, Non-navigable waters, Legal aspects.
Identifiers: Debris.

This statute prohibits throwing or depositing any garbage or other refuse upon public areas, both land and water. All garbage should be placed in the proper containers. If the throwing or depositing is done from a motor vehicle, such fact shall constitute prima facie evidence that such was done by the driver. (Stewart-Fla)
W69-04162

WARREN PETROLEUM CORP V LEE (ACTION TO RECOVER DAMAGES FOR POLLUTION OF CREEK).

234 F 2d 207-211 (5th Cir 1956).

Descriptors: *Mississippi, *Saline water intrusion, *Water pollution effects, *Oil industry, Riparian rights, Saline water, Water storage, Fish toxins, Downstream brine disposal, Fishkill, Path of pollutants, Pollutants, Salinity, Water pollution, Lethal limit, Salt tolerance, Seepage, Wells, Judicial decisions, Damages.

Defendant petroleum company purchased land, upstream from plaintiff's land, for underground storage of liquified gas. The operation consisted of drilling wells into an underlying salt dome, pumping water in to create cavities, and removing the water. The water, which had a high salt concentration, was then stored in earthen pits. The controversy arose when some of the stored water began to seep into the creek that led through plaintiff's pasture land. Livestock, which drank from the creek, became ill. Some died and plaintiff sustained additional damages in selling sick cattle at a loss. Dead fish and breeding salt marsh mosquitoes caused further annoyance. Plaintiff brought suit to recover damages as a result of the salt pollution allegedly caused by defendant's operations. The jury returned a verdict for the plaintiff and awarded monetary damages. The appellate court affirmed, holding that evidence was sufficient for the jury to find that the salt poisoning was a probable cause of the disorder which affected plaintiff's stock, and that defendant's operations were the probable source of the salt. (Wheeler-Fla)
W69-04170

CHAPMAN V BEAVER DAM COAL CO (DRAINAGE OF MINE WATER).
327 S W 2d 397-400 (Ct App Ky 1959).

Descriptors: *Kentucky, *Acid mine water, *Strip mines, *Judicial decisions, Mining, Coal mines, Mine drainage, Mine acids, Mine water, Coal mine wastes, Legal aspects, Water pollution sources, Acidic soils, Acid streams, Streams, Farms, Damages, Discharges (Water).
Identifiers: Injunctions.

Plaintiff, a farmer, brought an action for damages and, in the alternative, for a permanent injunction against defendant coal companies. Defendants owned and worked land adjacent to plaintiff's farmland. Defendants were engaged in strip mining, and discharges from this mining operation flowed into a creek which ran through plaintiff's land. Plaintiff claimed damage to his farm and sought a permanent injunction prohibiting the discharge of mining wastes. The trial court dismissed the complaint, and the court of appeals affirmed, holding that no present damage had been shown and that the court could not grant an injunction based on fear of some possible damage in the indefinite future. (Sisserson-Fla)
W69-04173

BUSBY V INTERNATIONAL PAPER COMPANY (ACTION FOR DAMAGES AND INJUNCTION DUE TO STREAM POLLUTION).

95 F Supp 596-598 (W D La 1951).

Descriptors: *Louisiana, *Judicial decisions, *Water pollution, *Pulp wastes, *Riparian rights, Waste water (Pollution), Effluents, Water law, Mills, Industrial plants, Industrial wastes, Water pollution control, Water pollution sources, Pollutants, Pollution abatement, Damages, Downstream, Streams.
Identifiers: Injunction.

Defendant paper mill's discharge of effluent into a stream deprived plaintiff lower riparian owner of the ability to cultivate a small portion of land. Plaintiff sued for damages, and in the alternative, for an injunction against further pollution. The trial court allowed judgment for damages and reserved decision on the application of injunction as a question in equity. Defendant appealed. The appellate court denied the injunction, ruling that defendant was granted an adequate remedy at law. The court stated that the mill was a substantial asset to the community, and that the balancing of benefits and conveniences would induce court of equity to deny harsh remedy of injunction. Mention was made that plaintiff restricted its discharge to the seasons when crops had been substantially gathered, the stream full, and fishing, for practical purposes, had ended. (Wheeler-Fla)
W69-04174

CITY OF OXFORD V SPEARS (CITY'S LIABILITY FOR DUMPING SEWAGE INTO STREAM WHICH PASSES THROUGH PRIVATE PROPERTY).

87 So 2d 914-917 (Miss 1956).

Descriptors: *Mississippi, *Water pollution, *Damages, Judicial decisions, Water pollution sources, Wastes, Mortality, Pollution abatement, Riparian rights, Municipal wastes, Cities, Reasonable use.

Plaintiff landowner sued defendant city for damages to his land and loss of profits in his cattle business due to the city's dumping of raw sewage into a watercourse running through his land. This court affirmed the trial court's decisions to the city's liability for maintaining the nuisance but reversed it on the issue of damages. If maintenance of a nuisance renders land permanently unusable one is entitled to an amount equal to the market value of the land destroyed, measured by its value in the undamaged condition and fixed by the use to which the land was put. If land is temporarily damaged the measure of damages is the diminution in rental or usable value of the land. If the nuisance is abatable the amount of damages is limited to the loss of rental value over the period in which the nuisance is maintained plus any provable special or incidental damages, such as annoyance, discomfort, inconvenience and sickness. Where the evidence showed only a possibility that two cows died as a result of the contamination, the plaintiff was not entitled to recover any damages relating thereto. (Blunt-Fla)
W69-04177

5C. Effects of Pollution

THE EFFECT OF INDUCED TURBULENCE ON THE GROWTH OF ALGAE,
Georgia Inst. of Tech., Atlanta. School of Engineering and Georgia Inst. of Tech., Atlanta. Water Resources Center.
Lawrence W. Olinger.
Georgia Inst Tech, WRC Rep 0468, Dec 1968. 81 p, 20 fig, 2 tab, 47 ref, 4 append. 5T1-WP-62-03 and 04, FWPCA.

Descriptors: *Algae, *Photosynthesis, *Growth rates, *Turbulence, Chlorrela, Scenedesmus, Kinetics, Ecosystems.
Identifiers: Algal growth kinetics, Monod growth equation, Incident light utilization.

A laboratory study was made of the relationship between turbulence and utilization of incident light by algal cultures. It was found that the maximum growth rate constant of the Monod growth equation increased with increasing turbulence and that the rate at which constant growth occurred was a function of turbulence. With constant illumination of 600 ft - candles and variable turbulence, the growth rate constant varied from 1.65 to 8.5. (Knapp-USGS)
W69-03730

MICROBIOLOGY OF OCEANS AND ESTUARIES,
Miami Univ., Fla. Inst. of Marine Science.
For primary bibliographic entry see Field 02L.
For abstract, see .
W69-03752

FISH HATCHERIES: POLLUTION OF WATERS USED BY FISH HATCHERIES.

NJ Stat Ann sec 23:8-5 (1940).

Descriptors: *Legislation, *New Jersey, *Water pollution effects, *Fishkill, Fish hatcheries, Water pollution sources, Fish toxins, Sewage disposal, Drainage practices, Water pollution control, Legal aspects.
Identifiers: *Poisonous substances.

This statute deals with the prohibition against polluting any waters used by a state fish hatcher. It provides that no person shall put any poisonous substance in the water. Neither shall any poisonous substance be allowed to fend its way or run into such waters. In cases of pollution by substances known to be injurious to fish or fish food, it shall not be necessary to prove that the substances actually caused the death of any particular fish. Violators of this section are subject to a $500 dollar fine. (Stewart-Fla)
W69-03843

WATER POLLUTION IN THE GREAT LAKES BASIN,
Federal Water Pollution Control Administration, Great Lakes Region, Chicago, Ill.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03948

THE ECOLOGICAL ROLE OF PHOSPHORUS IN WATERS WITH SPECIAL REFERENCE TO MICROORGANISMS,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Biology.
John E. Phillips.
Principles and Applications in Aquatic Microbiology, Proc Rudolfs Res Conf, Rutgers Univ, pp 61-81, 1963. 11 fig, 14 ref, disc.

Descriptors: *Cycling nutrients, *Phosphorus, *Microorganisms, Turnovers, Incubation, Lakes, Sediments, Sediment-water interfaces, Plants, Phosphorus compounds, Phosphorus radioisotopes.

Importance of microorganisms in exchange of phosphorus between water phase, sediments, higher plants and zooplankton is evaluated in terms of (turnover) time required for transfer of P-32 from one phase to another using glass-jar-simulated lake systems. On adding phosphate to water, the immediate reaction is the transfer through the bodies of unicellular suspended life forms. Turnover time for this may vary between 5 minutes and several hours depending on factors such as temperature, light, cell density and availability of nutrients. Next, within hours, slower incorporation of inorganic phosphate into organic forms occurs within microbial cells. This microbial component represents a large phosphorus reserve in the water, presumably not available to other solid components until release and hydrolysis of the microbial cell phosphate occurs. Exchange with higher plants appears to involve only dissolved inorganic phosphate, turnover time being of the same order as organic exchange. Conversely, exchange with zooplankton, occurring primarily through feeding on microorganisms and excretion, has turnover time of 1-2 days. When bacteria are inactive, turnover time for inorganic exchange with the sediment is 3 days for water, while the return to water is 15 days. (Harris-Wis)
W69-04023

THE SUCCESSION OF DIATOM ASSEMBLAGES IN THE RECENT SEDIMENTS OF LAKE WASHINGTON,
Washington Univ., Seattle. Dept. of Zoology.
John G. Stockner, and Woodruff W. Benson.
Limnol Oceanography, Vol 12, No 3, pp 513-532, July 1967. 20 p, 8 fig, 6 tab, 44 ref.

Descriptors: *Diatoms, *Eutrophication, *Sediments, Bioindicators, Data processing, Digital computers, Oligotrophy, Organic matter, Phytoplankton, Sewage effluents, Washington, Water pollution effects, Water pollution sources, Sedimentation rates, Nutrients, Plant pigments.
Identifiers: *Lake Washington (Wash), Sammamish River (Wash), Mercer Island (Wash), Cedar River (Wash), Seattle, Centrales, Araphidineae, Oscillatoria rubescens, Melosira italica, Tabellaria fenestrata, Asterionella formosa, Fragilaria crotonensis, Cyclotella, Shannon-Wiener information function, Shannon function, Wilcoxon's rank comparison, RV Onar, Diversity, Redundancy, Carotenoids, Chlorophyll degradation products.

Species composition of diatom remains in recent sediment from Lake Washington is strikingly correlated with pattern of sewage enrichment over past 80 years. In deeper sediment, deposited before cultural enrichment, relative composition of diatoms is constant. Indices of diversity and redundancy, calculated by the authors, also reflect constancy and near steady-state conditions. Estimation of sedimentation rates allowed derivation of an approximate temporal sequence. Changes in proportions of many diatoms, considered as trophic indicator species, correlated with historical changes in discharge of sewage into lake. Statistical treatment revealed shifts in species ranking, including change in dominance from Melosira italica to Fragilaria crotonensis at strata associated with settlement of Seattle. Reversal of this relationship at more superficial layers and its reestablishment near the mud-water interface correspond with diversion of sewage from Lake Washington about 1930 and sewage increases from 1941 to 1965. Authors interpret changes in species ranking, diversity, and redundancy in upper 30 cm of sediment as resulting from interaction between various species and degree of cultural enrichment. Ratio of Araphidineae to Centrales (A/C) closely followed this pattern, and A/C seems to be much more reliable indicator of lake's trophic status than fluctuations of individual indicator species.
W69-04029

5D. Waste Treatment Processes

WASTEWATER REUSE,
New York State Dept. of Health, Albany. Environmental Health Services Research Unit.
D. B. Stevens.
J Water Pollut Contr Federation, Vol 40, No 4, pp 677-683, Apr 1968. 7 p, 2 fig, 1 tab, 15 ref.

Descriptors: *Water reuse, New York, Recharge, Injection wells, Artesian wells, Aquifers, Groundwater movement, Tertiary treatment.
Identifiers: Long Island (New York).

In the population-concentrated East, wastewater reuse is a necessity simply because there is no space where wastewater can be dumped without affecting water resources. New York State's program of groundwater recharge and tertiary treatment of wastewater for ground injection is a plan to utilize wastewater as a source of supplemental water supply. A background of the problem is discussed with a description of current operations and future plans. Highest-quality effluents with ultimate waste disposal are considered.
W69-03716

WATER REUSE IN MONTERREY, MEXICO,
Celulosa y Derivados S. A., Monterrey (Mexico). Copropiedad Grupo Quimico.
H. J. Gomez.
J Water Pollut Contr Federation, Vol 40, No 4, pp 540-545, Apr 1968. 6 p, 1 tab.

Descriptors: *Water reuse, Industries, Municipal water, Irrigation, Reclaimed water, Tertiary treatment, Sewage, Water sources, Water utilization.
Identifiers: *Mexico, Monterrey (Mexico).

Extensive reuse of treated domestic wastewater for industrial uses is practical in Monterrey, Mexico. The aridness of the region, an extended drought, industrial development, and the population explosion necessitated this practice as early as 1955. Some industries treat and reuse water independently; others use central treatment facilities through a cooperative association. The water is used for watering gardens, cleaning of buildings and equipment, fire protection, cooling, boiler feed, and various industrial processes, with treatment for each use suited to the quality demanded. About 60% of the wastewater from a city of 1,000,000 is reused.
W69-03717

WASTEWATER REUSE--HAS IT 'ARRIVED,'
Federal Water Pollution Control Administration, Washington, D. C.
D. G. Stephan, and L. W. Weinberger.
J Water Pollut Contr Federation, Vol 40, No 4, pp 529-539, Apr 1968. 11 p, 1 fig, 5 tab, 3 ref.

Descriptors: *Water reuse, Industries, Irrigation, Municipal water, Reclaimed water, Tertiary treatment, Water utilization.

Most of the U. S. population today uses raw water supplies containing water which has been used previously for industrial or municipal purposes, or both. Withdrawal is not consumption; water is only used, and it is reused over and over. Nondeliberate reuse has been going on throughout history. Deliberate reuse is a more recent concept. Wastewater renovation for reuse is technically feasible and costs are related to the degree of treatment required to meet a particular reuse purpose. Through federal grants research on renovation techniques is underway on several different processes in widely scattered U. S. locations. Data on current process development, nominal pollutant removals, reuse applications and costs, and federal research grants to date are given.
W69-03719

NEW APPROACHES TO WASTEWATER TREATMENT,
Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Cincinnati Water Research Lab.
R. L. Stenburg, J. J. Convery, and C. L. Swanson.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6296, pp 1121-1136, Dec 1968. 16 p, 9 fig, 5 tab, 10 ref.

Descriptors: *Waste water treatment, *Environmental sanitation, *Pilot plants, *Research facilities, *Research and development, Design data, Tertiary treatment, Biological treatment, Nutrients, Economic justification, Water reuse, Underground storage, Sanitary engineering.
Identifiers: *Advance treatment techniques, *Waste streams.

Several new wastewater treatment systems, mostly experimental or modified conventional processes are described. Aspects of research and development work on waste treatment technology by the Cincinnati Water Research Laboratory, FWPCA, are presented. Projects range from single-unit processes to complete treatment systems that use biological, chemical, and physical treatment techniques with flows ranging from 200 gpd to several million gpd on the various projects. Objectives include learning of methods for reducing water pollution of a given type or at a specific location such that water can be produced suitable for underground recharge to prevent salt water intrusion, or for reuse in industrial, agricultural, recreational or other applications. Typical treatment techniques are two-stage lime precipitation with lime recovery and reuse, granular activated carbon adsorption, and several biological and chemical methods for removing the algal nutrients, nitrogen and phosphorus. (Lang-USGS)
W69-03746

DEACTIVATION OF WASTE WATERS FROM RADIOCHEMICAL LABORATORIES AND ATOMIC REACTORS (RUSSIAN),
A. A. Khonikevich.
Moscow, USSR, Atomizdat, 1966. 232 p, 76 fig, 48 tab, 244 ref.

Descriptors: *Waste water treatment, *Radioactive waste disposal, *Water reuse, Water pollution control, Chemical degradation, Waste assimilative capacity, Ion exchange, Coagulation, Nuclear reactors.
Identifiers: *Radiochemical laboratories, Deactivation of wastes, USSR.

The principal methods of deactivation of waste waters from radiochemical plants and laboratories and nuclear reactors are outlined and described. Equipment and techniques necessary for waste water treatment and for water pollution control, including basic technological plant diagrams used in the Soviet Union, are described. Detailed data are given about treatment of weekly volumes of radioactive liquid wastes, including such technology as ionic exchange, coagulation and coprecipitation. The book contains chapters on radiochemical laboratories, liquid wastes of experimental atomic reactors, summary of the development of techniques for deactivation of waste waters, main technological plant designs for waste treatment, and group solutions of plant problems on deactivation of waste waters. (Gabriel-USGS)
W69-03964

CONTRACTS FOR PURIFICATION OF WATER AND SEWAGE - CONTRACTS FOR SEWERAGE DISPOSAL (RIGHT OF MUNICIPALITIES TO CONTRACT FOR EFFECT SEWERAGE).

N Y Gen Mun sec 120-120a (McKinney 1965).

Descriptors: *New York, *Legislation, *Sewage, *Contracts, Cities, Sewage disposal, Municipal wastes, Sewage districts, Sewerage, Water purification, Local governments, Legal aspects, Engineering.

Section 120 authorizes authorities of cities, towns and villages to enter into contracts with owners of any process or apparatus for the purification of water and sewerage and either contract for its use for a term of years or for its purchase. It is declared lawful for two or more municipalities to jointly provide a sewerage system and construct whatever is necessary to effect the system. They may contract with third parties for the removal of sewage. They may also contract with an engineer to survey and plan an effective sewage system. It shall be lawful for these authorities to enter at all times upon any land or water for the purpose of exploring, surveying, and laying out the routes of such sewerage system. Section 120-a provides that municipalities may contract with themselves or with third persons for a system for removal and disposal of sewerage. If a sewerage system from one municipality passes through another municipality, that municipality may contract for the privilege of connecting its system to it. (Shevin-Fla)
W69-03992

NITROGEN REMOVAL IN SEWAGE TREATMENT PROCESS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
K. Wuhrmann.
Verh Int Ver Limnol, Vol XV, pp 580-596, Feb 1964. 17 p, 9 fig, 30 ref, disc.

Descriptors: *Eutrophication, *Water pollution control, *Water pollution sources, *Nitrogen compounds, *Sewage treatment, Water quality, Tertiary treatment, Percolation, Trickling filters, Activated sludge, Cycling nutrients, Denitrification, Nitrogen cycle, Sewage effluents, Microbiology, Phosphorus compounds, Pseudomonas, Nitrogen fixation, Sewage lagoons, Sewage bacteria, Sulfur compounds, Groundwater.
Identifiers: Zurich (Switzerland), Heterotrophy, Land disposal, Sulphate reduction.

Nitrogenous compounds derived from sewage probably play a significant role in eutrophication and nitrate-enrichment of groundwaters, although detailed knowledge of their involvement is still forthcoming. Author has reviewed nitrogen removal by conventional treatment processes. Land disposal, pond treatment, and biological oxidation, in trickling filters or with activated sludge, remove not more than 50% of total nitrogen from waste water, percentages ineffective in preventing enrichment of receiving waters. Over 90% removal has been achieved with physico-chemical processes of ion exchange and ammonia stripping at high pH, methods which are presently uneconomical. Microbial denitrification may be a practical technique of nitrogen elimination. Already occurring during conventional biological treatment, denitrification can be optimized to achieve 90% elimination from sewage. Author describes technical scale experiments which easily achieved highly reliable denitrification. In the experiments, final effluents after treatment of domestic sewage (total nitrogen after preliminary sedimentation, 25-30 ppm) contained 2-4 ppm. Attainment of complete anaerobiosis during an extra detention step was essential for such removal. Subsequent phosphorus precipitation yielded effluent with 1-2 ppm total nitrogen. Report contains record of brief floor discussions relative to phosphate removal, characteristics of denitrifying flora, sulfate reduction, and nitrogen fixation by cyanophytes.
W69-04030

COLLECTION, CHARACTERIZATION, AND STUDY OF BIODEGRADABILITY AND CHEMICAL OXIDATION OF CARBON-ABSORBED MATERIALS FROM EFFLUENTS FROM SEWAGE TREATMENT PLANTS,
Iowa State Univ., Ames. Dept of Civil Engineering.
R. L. Johnson.
Eng Res Inst., Final Report, Dec 1968. 96 p, 3 tab, 32 fig, 11 ref, 1 append.OWRR Project A-007-Iowa.

Descriptors: Adsorption, *Biological treatment, *Effluents, Similitude.

Organic materials found in sewage treatment plant effluents were adsorbed on activated carbon filters. The adsorbed material, after solution and concentration from the activated carbon, was fractionated according to solubility. Attempts were made to identify and characterize the organic materials, but the task was almost impossible. Most fractions were capable of further biodegradation as well as chemical oxidation when in the more concentrated form. A new tertiary or secondary biological treatment process of Pulsating Adsorption Beds (PAB) was developed using the adsorption phenomena as a concentration effect to enhance biodegradability. The process showed removals of 80 to 90% of the soluble organic carbon in a synthetic sewage at 125 million gallons per acre per day hydraulic loading and 265 pounds BOD per thousand cubic foot per day organic loading.
W69-04132

AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
Harvard Univ., Cambridge, Mass.
Leonard Ortolano, and Harold A. Thomas, Jr.
Harvard Water Program, Discussion Paper No 67-4, Harvard Univ, Nov 1967. 37 p, 2 fig, 5 tab, 13 ref, 1 append.

Descriptors: *Mathematical models, *Water pollution control, Alternative costs, *Waste water treatment, Water management (Applied), Bypasses, Estuaries, Aeration, Sewers, Sediment-water interfaces, Standards, Dissolved oxygen, Economic efficiency, Stream improvement, River systems, Delaware River.
Identifiers: Non-treatment alternatives.

A series of mathematical programming models were presented to investigate the relative merits of: (1) primary; (2) secondary; and (3) tertiary sewage treatment plants; (4) increase in stream reaeration coefficients; (5) control of combined sewer overflows; (6) removal of bottom sediments; and (7) piping of wastes outside basin for ocean disposal, in a program to maintain a given DO concentration at minimum cost. Sample computations and results for the Delaware Estuary were shown. The models were used as preliminary screening tools, beginning with simplified static models of the estuarine geometry, and evolving to sectioned dynamic models. (Gysi-Cornell)
W69-04142

MODEL OF OPTIMAL COMBINATION OF TREATMENT AND DILUTION,
Oklahoma Univ., Norman.
George W. Reid, Leale E. Streebin, and Robert Y. Nelson.
Proc Third Annu Amer Water Resources Conf, San Francisco, pp 339-350, Nov 1967. 12 p, 1 fig.

Descriptors: *Input-output analysis, *Low-flow augmentation, Mathematical models, Streamflow, *Optimization, *Waste water treatment, *Water pollution control, Municipal wastes, Industrial wastes, Statistics, Reservoirs, Costs, Digital computers.
Identifiers: Sensitivity analysis.

Stream input-output models were developed in terms of responses to biodegradable, nutritional, chemical and thermal loads. The models were developed as a function of stream parameters (e.g. reaeration coefficients, effective length, velveity) and quality criteria (e.g. DO, phosphorus, chlorides and temperature increases). Bacterial and sediment limits were handled as constraints. Given stream parameters and pollution criteria, the model provided optimal or least-cost combinations of waste treatment and dilution (low-flow augmentation). The methodology was responsive to stochastic changes, and capable of sensitivity analyses of pollution parameters. The entire program was computerized. (Gysi-Cornell)
W69-04144

OPTIMAL WATER QUALITY MANAGEMENT AND MULTI-COMPONENT EFFLUENT CONTROL BY MEANS OF LINEAR PROGRAMMING,
John P. Carew, and R. M. Van Slyke.
Operations Research Center Report 68-1, Univ of Calif, Berkeley, Jan 1968. 25 p, 6 tab, 14 ref.

Descriptors: *Linear programming, *Water quality control, Water management (Applied), Water policy, *Waste water treatment, Industrial wastes, Municipal wastes, Standards, Effluents, *Comparative costs, Economic efficiency, Planning, Water resource development.
Identifiers: Multicomponent effluents, Imputed costs.

A linear programming model for multicomponent effluent control was presented. The objective of the model was to prescribe levels of treatment by industrial and public classes of effluent dischargers in order to minimize total cost of treatment, subject to water quality constraints. Imputed costs per unit of each effluent component were obtained, allowing comparison of costs for different effluent composition, evaluation of proposed treatment schemes, and estimation of the effects of changing quality standards and increased discharges on optimal treatment policies. It was concluded that projections of future economic activity could be used with the model to predict future demands on treatment capability. (Gysi-Cornell)
W69-04147

5E. Ultimate Disposal of Wastes

ULTIMATE DISPOSAL OF WASTE WATER CONCENTRATES TO THE ENVIRONMENT,
Federal Water Pollution Control Administration, Cincinnati, Ohio.
Robert B. Dean.
Environ Sci Technol, Vol 2, No 12, pp 1079-1086, Dec 1968. 8 p, 52 ref.

Descriptors: Wastes, *Waste water, *Waste water disposal, *Waste water treatment, Water pollution control, *Sewage disposal, *Sanitary engineering, *Sewage sludge, Sludge disposal, Sludge treatment, Ultimate disposal, Municipal wastes, Brine disposal, Bibliographies, Pollution abatement, *Sewage treatment.
Identifiers: Sewage stabilization.

The Ultimate Disposal Research Activity of the Federal Water Pollution Control Administration is responsible for devising methods for treating waste residues so that they will not pollute the environment. Land and ocean sludge disposal, agricultural markets for sludge, and the fuel value of sludge are discussed. Surface and underground disposal of soluble waste, such as salt solutions, are also covered. Waste treatment processes described include oxidation, aerobic digestion, phosphate removal, lime treatment, nitrification ammonia removal, ion exchange, and removal of various elements and compounds. The only practical places for disposing polluting substances after they have been rendered innocuous are the air, land, and ocean. Surface fresh waters are not available for disposal. The ocean has long been used for waste disposal; however, warning signs are appearing showing that the ocean's assimilative capacity is not infinite and that effluents are not always rapidly dispersed. A pollutant is a substance that interferes with an intended use of the land, sea, or air, and society must decide on the best intended use. (USBR)
W69-03798

5F. Water Treatment and Quality Alteration

SEWERS, DRAINS - CHANGE OF COURSE OR OUTLET.

N J Stat Ann secs 40:63-13, 40:63-14 (1967).

Descriptors: *New Jersey, *Outlet works, *Drains, *Subsurface drainage, Sewers, Construction, Legislation, Riparian rights, Easement, Costs, Local governments, Cities, Riparian land, Ownership of beds, Grants, State governments.

The governing body may change the course and outlet of any sewer or drain before or after the construction thereof upon the application of any person. The municipality may exchange lands which were acquired for such drains for other lands necessary to make such change. The cost of the change shall be paid by the applicant as fixed by the governing body. If, in the construction of such drain in its changed course, it shall be necessary to cross any lands of the state under water in order to obtain an outlet, such lands may be taken and used for that purpose, and any lands of the state under water that were taken for use in the construction of the original drain, shall upon construction of such new drain on its changed course, revert to the state. If there has been a grant of such land to a riparian owner subject to the easement of the drain, such easement shall cease and determine, and the title of such grant shall become absolute. (Shevin-Fla)
W69-03858

5G. Water Quality Control

EFFECTS OF TEMPERATURE ON STREAM AERATION,
Newark College of Engineering, N. J. Dept. of Civil Engineering.
Ivan Metzger.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6309, pp 1153-1159, Dec 1968. 7 p, 2 fig, 2 tab, 9 ref, append. WP-01099-01 FWPCA.

Descriptors: *Aeration, *Streams, *Hydraulic models, *Temperature, Mathematical models, Oxygenation, Dissolved oxygen, Solubility, Dilution, Sanitary engineering, Sewage treatment.
Identifiers: *Water flow dilution.

The temperature coefficient of oxygen absorption in water is shown not to be constant but to be dependent upon turbulence and water temperature. Values of the coefficient were predicted by using the film penetration model and verified in open-channel model studies and mechanically stirred tanks. (Knapp-USGS)
W69-03742

STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.

La Rev Stat secs 56:1442-1444 (1965).

Descriptors: *Louisiana, *Administrative agencies, *Regulation, *Water pollution control, Legislation, Legal aspects, Bodies of water, Gulf of Mexico, Investigations, Water quality control, Public health water policy, Waste disposal, Streams.
Identifiers: *Penalties, Attorney general.

Any person who deems himself aggrieved by an order of the Stream Control Commission may file a sworn petition with the commission asking for a hearing. The result of the hearing on such matters is conclusive, although a review of the order may be had de novo in the district court. Any person who fails to file a report under section 1441 is found to be continuing the violation and is subject to criminal prosecution. The attorney general shall prosecute all violators, and the penalties shall range from $25 to $1000 or up to one year in jail. (Sisserson-Fla)
W69-03836

DRAINAGE OF NOXIOUS OR POISONOUS SUBSTANCES INTO NATURAL WATERWAYS OR CANALS.

La Rev Stat secs 56:1451-1453 (1965).

Descriptors: *Louisiana, *Water pollution control, *Administrative agencies, *Regulation, Oil wastes, Saline water, Drainage, Bodies of water, Legislation, Legal aspects, Streams, Reservoirs.
Identifiers: Penalties, Poisonous gases.

No person shall knowingly or willfully empty from any reservoir, pump, well, or oil field, into any natural stream of the state, any oil, salt water, or noxious or poisonous gases or substances in quantities sufficient to destroy the fish therein. The Commissioner of Wild Life and Fisheries shall supervise all drainage of salt water and other noxious substances into the natural streams of the state, and any owner or operator of oil producing property who discharges such substances in quantities sufficient to kill the fish shall be notified by the Commissioner to impound such substances. Any violator of this part shall be fined not less than $100 nor more than $2000, or imprisoned for not less than 30 days nor more than 3 months for each offense. Each day that such substances are permitted to flow into the streams of the state constitutes a separate offense. (Sisserson-Fla)
W69-03837

PROTECTION OF WATER SUPPLY FROM POLLUTION.

N J Stat Ann sec 40:62-67 (1967).

Descriptors: *New Jersey, *Water pollution, *Public health, *Drains, Sewers, Sewage disposal, Legislation, Local governments, Cities, Drainage districts, Drainage systems, Construction, Water pollution control, Water quality control, Administrative agencies.

In municipalities having a public water supply obtained from a source beyond the municipal limits, the board or body having the control of such water supply may, when necessary to protect such water from pollution, construct, maintain and operate, within this territory from which the water is derived or through which it flows, a system of drains and sewers for intercepting, taking off and disposing of all sewage or other polluting matter. Every such system shall provide for the disposal of the sewage and other polluting matter taken up, at a place and in a manner to render the same harmless. The construction of such system of drains and sewers shall not be commenced or entered upon, unless and until the state department of health shall approve the construction thereof as a sanitary measure, shall approve the plans therefore, which shall be submitted to it, and shall define in a general way the limits of the district or territory within which or for which such system of drains or sewers shall be constructed. (Shevin-Fla)
W69-03855

PILOT STUDY OF DYNAMICS OF RESERVOIR DESTRATIFICATION,
Robert S. Kerr Water Research Center, Ada, Okla.
Lowell E. Leach, William R. Duffer, and Curtis C. Harlin, Jr.
Fed Water Pollut Contr Admin Rep, 1968. 22 p, 7 fig, 1 tab, 13 ref.

Descriptors: *Thermal stratification, *Reservoirs, *Dissolved oxygen, *Aeration, *Mixing, On-site tests, Oklahoma.
Identifiers: Eufaula Reservoir (Okla), Destratification.

A pilot study of the dynamics of destratification of a large reservoir by utilizing a compressed air diffusor system was made at Eufaula Reservoir, Oklahoma, in summer and early fall, 1967. Measuring stations were located 500 ft apart at 25 points in a cross-shaped pattern in the project area. Vertical temperature and dissolved oxygen profiles were measured at 5-foot intervals from the surface to the bottom. The thermocline was 22 ft below the surface. Dissolved oxygen ranged from 10 to 6 ppm at the surface and decreased to 5 ppm at 22 ft, and to near zero at the bottom. Destratification was attempted with a cross-shaped array of diffusors 40 ft square spaced 3 ft apart on the outer 9 ft of each leg. Air was delivered at 140 cfm and 65 psig initially, and 95 cfm and 45 psig after 25 days. Concentration of dissolved oxygen increased together with warming of water. After 2 days the 4.0 ppm oxygen level lowered from 28 ft to 35 ft with a radius of 1000 ft from the center of the system, to 40 ft with a radius of 6,500 ft after 4 days, and reached a maximum depth of 50 ft with a radius of 14,200 ft at 25 days. A volume of water of 65,800 acre-ft was aerated. (Knapp-USGS)
W69-03960

PESTICIDE OCCURRENCE, CONCENTRATION, AND DEGRADATION IN FREE WATER SYSTEMS,
Massachusetts Univ., Amherst.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03962

CITY OF FORT WAYNE V MAPLEWOOD PARK UTIL (CONSTITUTIONALITY OF STATE COMBINED SEWAGE DISPOSAL AND WATER ACT).

241 N E 2d 805-808 (App Ct Ind 1968).

Descriptors: *Indiana, *Public utilities, *Legislation, *Classification, Rural areas, Water works, Sewage disposal, Judicial decisions, Legal aspects, Cities, Sewers, Water supply, Water users.
Identifiers: *Constitutional law.

Maplewood Park Utilities, Inc., applied to the Public Service Commission for a certificate to render combined sewer and water service to an area outside the city of Fort Wayne. The City of Fort Wayne and its public works board opposed the application. The Commission awarded the certificate to Maplewood to render service exclusively. The constitutionality of the state Combined Sewage Disposal and Water Act of 1963 was attacked on appeal to this court. The court reversed the order of the commission, holding the act to be violative of the state constitution. The Act granted rights to private utilities to render combined sewer and water services, which it did not grant to municipal utilities, public water companies or public sewage companies. The court ruled that the basis of the Act had no reasonable relation to the end of providing residents in rural areas with water and sewage disposal service. (Wheeler-Fla)
W69-03983

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.

N Y Pub Health Law sec 1180 (McKinney Supp 1968).

Descriptors: *New York, *New England, *Water pollution, *Interstate compacts, Legislation, Interstate rivers, Administrative agencies, Administrative regulation, Water quality, Standards, Tidal waters, Sewage treatment, Navigation, Interstate commissions, Legal aspects, Bodies of water, Water pollution control.
Identifiers: Interstate Water Pollution Control Compacts, Contiguous waters.

This section reestablishes the New England Interstate Water Pollution Control Compact the purpose of which is to abate existing pollution and to control future pollution in the interstate waters of the New England area. The Compact provides for the composition and procedures to be followed by the control commission. One of the primary functions of the commission is the establishment of reasonable standards of water quality satisfactory

for various classifications of use. The signatory states agree to have their own classification of interstate waters approved by the commission and to establish programs of waste treatment which will meet the commission's standards. The signatory states also agree to provide for the abatement and control of pollution in interstate waters and to maintain these waters in a condition consistent with the highest classified use for each body of water. (Childs-Fla)
W69-03990

AN ACT CONCERNING INDUSTRIAL WASTE DISPOSAL PROPERTY...EXEMPTING FROM TAXATION CERTAIN TANGIBLE PERSONAL PROPERTY.

Indiana Laws ch 174 (1967).

Descriptors: *Indiana, *Taxes, *Industrial wastes, *Treatment facilities, Administrative agencies, Water pollution, Judicial decisions, Facilities, Industrial plants, Waste water treatment, Legislation.
Identifiers: *Exemptions (Tax), Stream pollution control board.

Indiana allows an exemption from ad valorem property taxation for industrial waste control facilities. These facilities must be tangible personal property. The exemption applies to the State and any of its political subdivisions. Application for the exemption must be made to and approved by the Stream Pollution Control Board of Indiana. If the board does not grant the exemption appeal may be made to the circuit court of the county for which the property claimed for exemption is located. The appeal will be tried by a judge without jury and is subject to further appeal as in other civil cases. (Watson-Fla)
W69-04001

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
Delaware River Basin Commission, Trenton, N. J.
Ralph Porges.
International Conference On Water For Peace, Vol 8, pp 47-60, 1968. 13 p, 5 fig. For 8 volume Proceedings see Vol 2, No 9, Field 06B, W69-03305.

Descriptors: *Delaware River Basin Commission, *Water quality control, *Water pollution control, *Inter-agency cooperation, Delaware River, Administrative agencies, River basin commissions, River basin development, Waste water treatment, Water pollution treatment, Pollution abatement, Federal government, State governments, Water pollution, Rivers, River basins.

This water quality control article concerned the Delaware River Basin, which runs from the Catskill Mountains of New York down to the Delaware Bay below New Jersey. The pollution problem was centered on the estuary region, which begins at Trenton, New Jersey and extends some eighty-five miles to the Bay. The problem described results from municipal and industrial wastes being poured into the river. Control mechanisms of federal, state, and local agencies are discussed, and mention is made of municipal and industrial waste management programs. The article describes how the complexities of problems relating to streams forming state boundaries has led to the creation of interstate agency, which has been succeeded by the Delaware River Basin Commission. Under a 1961 compact, the Commission is an instrumentality of the four basin states and the federal government. The Commission's water resource development and water quality management responsibilities are discussed. Also included is how the Federal Water Pollution Control Administration aids the Commission. (Wheeler-Fla)
W69-04039

AIR AND WATER INTERSTATE COMPACTS.
Gulf Oil Corp., Philadelphia, Pa.

Nat Resources Lawyer, Vol 1, No 4, pp 60-69, Oct 1968, 10 p, 6 ref, 1 tab.

Descriptors: *Interstate compacts, *Water pollution, *Air pollution, Interstate rivers, Compacts, Federal government, State governments, Federal jurisdiction, Delaware River, Water control, Tennessee River, Water Resources Planning Act, River basin commissions, Legislation, Missouri River, Ohio River, Columbia River, Water quality control, Water pollution control, Legal aspects.
Identifiers: Potomac River, Susquehanna River, Water Pollution Control Administration, Air Pollution Control Act.

In recent years a number of interstate compacts have been negotiated in an effort to control air and water pollution. These compacts have become rather sophisticated in dealing with the numerous problem areas. The federal government has also become an active participant in a number of these agreements. It appears that Congress has, as a matter of policy, adopted the position that these compacts are to be encouraged, but, at the same time, has insisted that any standards set must meet federal criteria. The age of some of the water compacts and the striking lack of provisions to meet everyday problems encountered in pollution control render these compacts outdated and inadequate to meet modern day problems. It is possible that these and other conflicts will not be resolved this year or in the near future. If they are not, it is suggested that perhaps what is needed is an overall study and reevaluation of the use of the compact as an organizational form. (Heckerling-Fla)
W69-04047

POLLUTION.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04050

INDUSTRIAL WASTES ORDINANCE ENFORCEMENT HELPS ABATE POLLUTION AT CHICAGO,
Allen S. Lavin.
Water and Wastes Engineering, Vol 5, No 9, pp 1-27--1-29, Sept 1968. 2 p.

Descriptors: *Pollution abatement, *Industrial wastes, Industries, Industrial plants, Water pollution sources, Water pollution control, Water pollution, Public health, Sanitary engineering, Legislation.

The attorney for the Metropolitan Sanitary District of Greater Chicago states that there is no reason today to accept any type of pollution. The central problem lies in the sluggish pace of the enforcement program, and the solution lies in strengthening of this enforcement program. In this regard, the Metropolitan Sanitary District of Greater Chicago has recently taken the firm position, in hearings concerning violations by big industry of its anti-pollution ordinance, that the ordinance is clear, that there is a standard definition for pollution, and that costs and productive value to a particular industry is not the prime concern. The prime concern is the health, welfare, and economics of our entire community. The article concludes with the thought that we have the technical know-how, the money and the manpower; we now should develop the will to enforce anti-pollution laws. (Carruthers-Fla)
W69-04053

INTERSTATE WATER POLLUTION CONTROL ACT.
Me Rev Stat Ann tit 38, secs 491-537 (1965).

Descriptors: *Maine, *New England Interstate WPS Compact, *Water pollution control, *Legislation, Water quality, Water pollution, Water quality control, State governments, Cooperatives, Interstate compacts, Interstate rivers, Water policy, Water law, Interstate commissions, Legal aspects, Connecticut, New Hampshire, Massachusetts, Rhode Island, Vermont.

The State of Maine has enacted the New England Interstate Water Pollution Control Compact. The other signatory states are Connecticut, Massachusetts, New Hampshire, Rhode Island, and Vermont. The act represents a recognition of pollution problems of interstate streams, ponds, lakes, and tidal waters ebbing and flowing past boundaries of two or more states. The stated purpose of the act is to foster cooperation between the New England states in establishing an effective interstate agency to work with the states. Subchapter (2) includes two articles: Article One describes the compact, including sections concerning waters covered by the act, and details the commission structure, standards and classifications, appropriations, and provisions for negotiation with New York. Article Two concerns the administrative provisions, including sections regarding the form of execution by the governor, appointment of commissioners, reservations, and appropriations. (Wheeler-Fla)
W69-04154

ARTICLE ONE, SUBCHAPTER TWO, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT (DETAILS OF THE COMPACT).
Me Rev Stat Ann tit 38, secs 491-501 (1965).

Descriptors: *Maine, *New England Interstate WPS Compact, *Water pollution control, *Legislation, Interstate compacts, Water quality, Water pollution, Water quality control, State governments, Cooperatives, Interstate rivers, Water policy, Water law, Interstate commissions, Legal aspects, New York.

These sections of the Act limit its application to interstate inland and tidal waters. The Act creates a commission made up of five appointed members from each state, representing various fields of interest. Procedures for organization and operation are specified. Provision is made for the establishment of different standards of water quality for various classifications of use. A pledge is included providing for pollution abatement and future control of interstate waters. Maximum appropriation obligations of each state is set out, with Massachusetts being the major contributor. The commission is authorized to negotiate with New York regarding abatement of pollution in waters flowing between New England and New York. (Wheeler-Fla)
W69-04155

ARTICLE TWO; SUBCHAPTER TWO; NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
Me Rev Stat Ann tit 38, secs 531-537 (1965).

Descriptors: *Maine, *New England Interstate WPS Compact, *Water pollution control, *Legislation, Interstate compacts, Administrative agencies, Water quality, Water pollution, Water quality control, State governments, Cooperatives, Interstate rivers, Water law, Interstate commissions, Legal aspects.

The Governor of Maine is directed to execute the compact described under Article One in conjection with any one or more of the other six New England states listed. The Act directs that five commissioners be appointed from Maine, two of which are to be, respectively, the commissioner of Health and Welfare and the Chairman of the Water Improvement Commission. The other three are to be appointed by the Governor with a view toward representing municipal, industrial, and general public interests. The Commissioners are to serve without compensation, but expenses incurred in line of service are reimbursable. Reservation is made concerning appointees to the interstate com-

mission from Maine; these persons have no authority to commit any interest within Maine to any higher classification than was already established by Maine law, nor to any classification of interstate waters of Maine which have not been assigned a classification under Maine law. Maine limited appropriations for commission expenses to $1000.00. The importance of pollution control of interstate waters is recognized, and the act states that the best method to accomplish the goal is through interstate cooperation. (Wheeler-Fla)
W69-04156

AN ACT RELATIVE TO EXPANDED STATE ACTIVITY IN THE FIELD OF WATER POLLUTION CONTROL.
Laws of New Hampshire ch 147 (1967).

Descriptors: *New Hampshire, *Surface waters, *Sewage disposal, Legislation, Administrative agencies, Sewage treatment, Water pollution sources, Classification, Permits, Regulation, Water policy, Grants, Shores.

Chapter 147 was passed to expand existing New Hampshire laws dealing with water pollution. The act created and defined the composition of the water supply and pollution control commission, as well as specifying the qualifications and numbers of the commission's employees. Existing standards for the classification of surface waters were amended. A permit was required to dispose of sewage into surface water. Marine toilets must have treatment devices attached to them and none of the treated sewage may be deposited within 500 feet of the shoreline. To receive state grants, recommended pollution control facilities must be installed and in operation. Chapter 147 also added a new chapter, 149E, which was entitled 'Sewage Disposal Systems Near Shorelines.' The purpose of the new chapter was to prevent pollution in the surface waters of the state. Any construction of a sewage system or a subdivision near the shoreline must be preceded by the submission of plans and specifications to the water pollution commission for approval. The chapter provided enforcement procedure and penalties for violations. (Sisserson-Fla)
W69-04178

NORTH CAROLINA STATE STREAM SANITATION AND CONSERVATION COMMITTEE.
N C Gen Stat sec 143-211--143-215.7 (1964).

Descriptors: *North Carolina, *Legislation, *Water pollution control, *Administrative agencies, Water quality, Public health, Standards, Water pollution effects, Water quality control, Regulation, Inspection, Permits, Water policy.
Identifiers: Commissions, Penalties (Civil).

This article establishes a State Stream Sanitation Committee composed of 7 members who represent and have field experience in water pollution prevention and abatement. The Committee shall have the responsibility of identifying and classifying all the waters of the state per the criteria set forth in section 143-215 (d) (1-4). Prior to assigning a classification to an identified water body, the Committee shall conduct public hearings and receive evidence on the matter. After a stream is classified no person may alter the construction of, increase the quantity of, or change the nature of any sewage or disposal system, within the area without first receiving a permit from the Commission. The act encourages voluntary cooperation among those causing pollution to act to eliminate it, but, if need be, the Commission is authorized to issue special orders ordering the abatement of pollution sources. The act specifies the effect of such orders when issued to private individuals or municipalities. The Committee has the power to adopt, modify or revoke its regulations, conduct investigations and delegate its powers to its employees, etc. The act provides civil penalties for violation of Commission regulations. The act has no effect on the sections of the statutes regulating public water supplies and sewer systems. (Blunt-Fla)
W69-04193

06. WATER RESOURCES PLANNING

6A. Techniques OF Planning

EFFECTIVE WATER RESOURCE MANAGEMENT.
TRW Systems, San Bernardino, Calif.

TRW Syst, Inc Rep, Apr 15, 1968. 74 p, 26 fig, 4 append. Grant 1579. OWRR Project C-1084.

Descriptors: *Systems analysis, *Water resources development, *Water management (Applied), River basins, Management, Operations research, Personnel management, Employee relations, Leadership, Social aspects, Hydrologic aspects.
Identifiers: Systems, Project management.

The use of the systems approach to water management is explained in a handbook intended for the use of water resource managers. The most appropriate geographical unit for planning purposes is the river basin. River basins in the management sense include all human activities as well as the physical aspects of the area. The systems approach to management includes basin hydrological and meteorological analysis, planning, organizing, staffing, direction, and control. Flow charts illustrate the process of decision making in the operational and project modes. Organizational charts are used to present the recommended organizational structure. The Upper Santa Ana River Basin, California, is used as an illustration of the systems approach to water resource management. (Knapp-USGS)
W69-03702

DEVELOPMENT AND APPLICATION OF A RATIONAL WATER QUALITY PLANNING MODEL,
Clemson Univ., S. C.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-04017

POOLING OF TIME SERIES AND CROSS SECTION DATA,
Columbia Univ., New York.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-04066

COMPETITIVE EQUILIBRIUM UNDER UNCERTAINTY,
California Univ., Berkeley.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-04078

THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
City Univ. of New York; and Princeton Univ., N. J.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-04088

DEVELOPMENT OF OPTIMIZATION - SYSTEMS ANALYSIS TECHNIQUES FOR TEXAS WATER RESOURCES,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-04133

SIMULATION OF A NATIONAL FLOOD INSURANCE FUND,
Florida Univ., Gainesville; and Harvard Univ., Cambridge, Mass.
John C. Schaake, Jr. and Myron B. Fiering.
Water Resources Res, Vol 3, No 4, pp 913-929, 4th Quarter, 1967. 17 p, 4 fig, 10 tab, 6 ref.

Descriptors: *Simulation analysis, *Flood plain insurance, Flood damage, Compensation, Costs, Statistics, Optimization, Rates, Discount rate, Water management (Applied), Water policy, Synthetic hydrology.
Identifiers: National fund.

A simulation model of a national flood insurance fund was structured. The objective was to determine near optimal values of premium rates, discount coefficients, initial capitalized value, and the reinsurance structure. The model synthesized flow traces, mapped them into damages, collected premiums, indemnified losses, collected reinsurance premiums from the insurance industry, and indemnified that industry's excess losses. Relevant statistics were accumulated. The mean and variance of simulated flood damages agreed well with other studies. Exponential growth in the variance of the fund over time was observed. It was concluded that this growth could be controlled by proper management of the fund. (Gysi-Cornell)
W69-04138

AN EXAMINATION OF NON-TREATMENT PLANT ALTERNATIVES IN WATER POLLUTION CONTROL,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-04142

6B. Evaluation Process

THE TEXAS WATER PLAN.
Texas Water Development Board, Austin.

Tex Water Develop Board Rep, Nov 1968. Main rep, total 207 p, 37 fig, 4 plate, 74 tab, sum rep, 50 p, 3 plate, 2 tab.

Descriptors: *Planning, *Water resources development, *Texas, *Inter-basin transfers, Interstate, Financial feasibility, Legal aspects, Legislation, Multiple-purpose projects.
Identifiers: Water importation, Texas Water Plan.

The Texas water plan is outlined and summarized. It is concluded that the projected water needs of the state may be satisfied only by a system for the redistribution of water within the state and importation of water to the state. Studies by the USGS, Bureau of Reclamation, Corps of Engineers, and the state of Texas of feasibility and engineering design of a water importation and distribution system are summarized. A list of recommendations for legislative action on the state, local, and national levels is presented. Texas expects to need 12-13 million acre-ft per yr of imported water by the year 2020. The proposed source is the Mississippi River, from which water will be moved westward into Texas and pumped over 3,000 ft up to the High Plains of west Texas and eastern New Mexico. (Knapp-USGS)
W69-03729

ANALYTICAL USES OF ENERGY BALANCES,
Bureau of Mines, Washington, D. C.
William A. Vogely.
Pap, World Power Conf, Aug 1968. 15 p, 6 tab.

Descriptors: *Energy, *Energy balance, *Forecasting, Models, Costs, Economies, Technology, Nuclear energy, Electric power production, Coals, *Analysis, *Electric power demand, Efficiencies, Resources, Petroleum, Hydroelectric power.
Identifiers: Fossil fuels, Nuclear power.

Four major analytical uses of energy balances are described and examples furnished. Forecasting: A projection to 2000 AD of the U S energy balance indicates a 3-fold increase in energy inputs with a substantial shift to electricity and nuclear power. Resource Adequacy: Models of all fuel economies

are used to test outside limits of resource adequacy. Such an approach is needed because of the high levels of substitution possible between energy sources. Resource Efficiency: Two approaches to efficiency are developed. The first indicates the cost (in resource terms) of the trend toward secondary energy use; the second illustrates the impact of resource-saving technology on gross energy inputs. Consumption Shift Analysis: A shift model of energy consumption (1947-1966) and a behavioral equation for each source by sector are developed. The equation permits historical changes to be distributed among 3 factors: market growth, price substitution, and a residual technology change. Analysis indicates that growth in the market is the major contributor to change, but that increased efficiency negatively affects growth in 3 sectors and new uses reinforce the change in household and commercial sectors.
W69-03772

WATER DEVELOPMENT AND WATER PLANNING IN THE SOUTHWESTERN UNITED STATES,
Aarhus Univ. (Denmark). Inst. of Economic and Applied Geography.
Johannes Humlum.
Kult Inst Skrift No 4, Aarhus Univ, 1969. 240 p, 107 fig, 15 tab, 191 ref.

Descriptors: *Water resources development, *Planning, *Southwest U. S., *Urbanization, California, Arizona, Central Valley Project, Interbasin transfers, Dams, Multiple-purpose projects, Irrigation, Recreation, Powerplants, Municipal water, Reclamation, Social aspects, Legal aspects, Economic impact.
Identifiers: NAWAPA, Urban growth-water import relationships, Urban environment.

Water planning in the southwestern U. S. in the last 50 yr is surveyed and future wide-scale plans for transferring water into irrigated areas are reviewed. The close dependence of the localization of population in southern California and central Arizona and the distribution of water is shown. The influence of water development on population congestion is self-reinforcing and results in growth which may not be socially or economically beneficial, and causes pressure for recreational facilities in areas that often cannot support heavy use. In the southwestern U. S., an originally fine climate attracted people until population growth took on a cancerous aspect. Urbanization and pollution have affected the climate and made the area less livable. The question of the desirability of furthering this development by constantly extending cities, roads, urban areas, and importing water is considered in detail in the worldwide outlook. The history and physical facilities of the water-supply works and irrigation projects of the southwest are described in detail. It is concluded that water demand can be satisfied only by increasingly long inter-basin transfers and desalination of sea water. The large-scale transfer projects must be studied carefully to avoid doing more harm to the environment and to the economy of water-exporting areas, than good to urban areas. Water rights laws need to be uniform and to take transfers into account. An annotated bibliography of 214 entries is included. (Knapp-USGS)
W69-03949

PEOPLE AND WATER,
Oregon State Univ., Corvallis, Oreg. Water Resources Inst.
For primary bibliographic entry see Field 04C.
For abstract, see .
W69-03953

GEOLOGY AS A GUIDE TO REGIONAL ESTIMATES OF THE WATER RESOURCE,
New Jersey Geological Survey, Trenton. Dept. of Conservation and Economic Development.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03961

RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
Interstate Advisory Committee on the Susquehanna River Basin.

Interstate Advisory Committee on the Susquehanna River Basin, 2101 North Front Street, Harrisburg, Pa., 1965, 83 p, 3 map, 23 chart.

Descriptors: *Methodology, *Decision making, *Inter-agency cooperation, *New York, *Pennsylvania, *Maryland, Water resources, Administrative agencies, State governments, Federal government.
Identifiers: Susquehanna River Basin.

After a brief description of the basin and of the purpose of projected programs, the report is divided into four sections. The first outlines what a comprehensive basin study should include. The second discusses and charts the complex organization of official bodies involved with the survey as well as their inter-relationships. The third section describes federal-state coordination, and newly created committees and task forces which deal with the interests and responsibilities of the participating 25 federal agencies. These charts are based on 10 subjects of major concern in the study. Simplified charts showing the channels of authority and communication between these agencies are also included. Finally, an outline of the interests and responsibilities relating to resources of agencies of the three basin states, New York, Pennsylvania, and Maryland. Channels of coordination between agencies within a state, in different states, and with the federal government are described. (Gossen-Chicago)
W69-04032

WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
Michigan Univ., Ann Arbor.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04037

ECONOMIC AND SOCIAL BENEFITS FROM IMPROVING HEALTH BY PROVISION OF SAFE DRINKING WATER SUPPLIES,
Public Health Service, Washington, D. C.
Floyd B. Taylor, William N. Long, and Paul W. Hughes.
For 8-Volume Proceedings see Vol. 2, No. 9, Field 06B, W69-03305. International Conference on Water for Peace, Vol 8, pp 107-116, 1968. 10 p, 3 tab, 4 fig, 9 ref.

Descriptors: *Social aspects, *Water quality, Supply.
Identifiers: *Public health, Economic terms.

This paper discusses the positive health assets of providing adequate water supplies in economic terms such as increased gross national product, savings in medical costs, increase in contributed taxes, and also in social terms such as effect on birth rates and improved morale. In terms of the world, water-borne disease is the major single cause of death and morbidity. Therefore, water supply becomes the principal focus of priority in needed environmental improvements. The effect of adequate quantity (as quantity increases there usually is betterment of health) is also discussed together with the interrelationships between quantity and quality. (Grossman-Rutgers)
W69-04056

TRIBUTARY AREA DEVELOPMENT: TVA'S APPROACH TO SUB-REGIONAL DEVELOPMENT,
Tennessee Valley Authority, Knoxville.
Richard E. Brown, and Glen D. Weber.
Land Economics, Vol 45, No 1, pp 141-146, Feb 1969. 6 p, 6 ref.

Descriptors: *Tenessee Valley Authority Project, Benefits.
Identifiers: *Tributary Area Development.

Tributary area development (TAD) is essentially an approach which utilizes local interest and initiative, both governmental and private citizen, to carry forward a comprehensive resource development effort directed at uplifting the social and economic well-being of residents of sub-regions of the Tennessee Valley. The history of the TVA has been one of cooperation with local and state governments in their efforts to develop local areas. This paper describes TVA's tributary area development program. It reviews a few of its accomplishments, and it suggests some problem areas for further consideration and research. (Grossman-Rutgers)
W69-04057

TOWARDS ECONOMIC EVALUATION OF THE QUALITY OF WATER IN IRRIGATION,
Hebrew Univ., Jerusalem (Israel).
For primary bibliographic entry see Field 03C.
For abstract, see .
W69-04059

THE BIAS OF LIVIATAN'S CONSISTENT ESTIMATOR IN A DISTRIBUTED LAG MODEL,
Delhi Univ., (India).
A. L. Nagar, and Y. P. Gupta.
Econometrica, Vol 36, No 2, pp 337-342, April 1968. 6 p, 3 ref.

Descriptors: *Simulation analysis, *Statistical models, *Economics.
Identifiers: Bias, Liviatan's consistent estimator, Distributed lag, Asymptotic covariance matrix.

In an earlier article published in the International Economic Review (1963) Liviatan proposed a consistent estimator for a distributed lag model. In the present note the authors analyze the bias of this estimator to order 1/T, T being the number of observations. Water simulation studies often encounter the statistical problems of distributive lags and autocorrelation and therefore this paper's generalization of the consistent estimator property for a distributive lag model is relevant to empirical models in water research which utilize this structural basis. (Loeb-Rutgers)
W69-04060

RESTRICTED BARGAINING FOR ORGANIZATION WITH MULTIPLE OBJECTIVES,
Fondazione l'Einaudi, Turin (Italy); and State Univ. of New York, Buffalo.
Bruno Contini, and Stanley Zionts.
Econometrica, Vol 36, No 2, pp 397-414, April 1968. 18 p, 7 fig, 22 ref.

Descriptors: Organizations.
Identifiers: *Restricted bargaining, *Multiple objectives, Incentive, Imposed solution, Pareto optimal, Threat, Concession.

In this paper it is shown that a bargaining game will yield a negotiated solution with certain reasonable properties if the rules of the game are appropriately restricted. The basic idea is to provide an incentive for all the group components to engage in a process of concession until the point where some agreement is reached. The incentive consists of the threat of a preannounced 'imposed' solution which will be enforced if no settlement can be reached. Theories of non market decision making are often invoked in the case of public goods and this paper has theoretical relevancy to an array of water issues from water rights and level of governmental decision process on expenditure allocations among alternatives. (Loeb-Rutgers)
W69-04061

A NOTE ON HOUTHAKKER'S AGGREGATE PRODUCTION FUNCTION IN A MULTIFIRM INDUSTRY,
Massachusetts Inst. of Tech., Cambridge; and Hebrew Univ., Jerusalem (Isreal).
David Levhari.

Econometrica, Vol 36, No 1, pp 151-154, January 1968. 4 p, 1 fig.

Descriptors: Industries.
Identifiers: *Aggregate production function, Multifirm, Distribution, Factor proportions, Neoclassical production function, Density function.

This note deals with Houthakker's approach of aggregating a production function for an industry. It tries to reverse Houthakker's procedure and to derive the distribution function of factor proportions from a neoclassical production function. Specifically, it derives the distribution function for a CES production function. Economic studies of the 'water industry' are numerous and implicitly involve both the aggregation and factor distribution issues discussed in this paper. (Loeb-Rutgers)
W69-04064

SIMULTANEOUS CONFIDENCE INTERVALS IN ECONOMETRIC FORECASTING,
Michigan Univ., Ann Arbor.
Saul H. Hymans.
Econometrica, Vol 36, No 1, pp 18-30, January 1968. 13 p, 1 fig, 1 tab, 12 ref.

Descriptors: *Forecasting, Regression analysis.
Identifiers: Confidence interval, Econometrics, Confidence ellipsoid, Simultaneous equations, Random variable.

Forecasting a vector of jointly dependent random variables frequently leads to the consideration of a confidence ellipsoid. Joint confidence intervals can then be derived if the projections of the ellipsoid on a set of coordinate axes can be calculated. In this paper an expression for such projections is derived and then the application to econometric forecasting is presented. Much empirical work in water research employs regression analysis (demand estimations, stream simulations) and involves forecasting problems. The method of forecasting confidence ellipsoids suggested here has relevance to statistical water analyses that consider problems involving empirical forecasting. (Loeb-Rutgers)
W69-04065

QUANTITATIVE VS. QUALITATIVE STANDARDS FOR EVALUATING MANAGERIAL EFFICIENCY IN PUBLIC UNDERTAKINGS,
George C. Maniatis.
Indian Econ Jour, Vol 14, No 5, pp 576-89, Apr-June 1967. 24 p.

Descriptors: Management, Performance, Efficiencies, Administration, Profit, Economic efficiency, Economics, Cost, Social aspects.
Identifiers: Public enterprise, Cost minimization, Relative cost reduction.

While it is normally believed that the managerial efficiency of public enterprises must be appraised by a qualitative rather than a quantitative criteria, the author maintains that a properly qualified profitability test--a quantitative standard--would provide a workable efficiency norm. He suggests that a test of efficiency may have the following desiderata: objectivity, reliability, simplicity, management's efforts to minimize costs, judgment of management in light of the prevailing environment, and furtherance of the social responsibility of management. It would be profitable to discriminate the social from economic performance of the public enterprise and to emphasize the significance of the latter. The resultant profit, after taking due account of the cost and revenue effects that go with socio-political or socioeconomic aims, could be regarded as an index of the management's operating efficiency. This article is relevant to studies of the operation of public water agencies and institutions. (Winn-Rutgers)
W69-04068

ECONOMETRICS OF JOINT PRODUCTION,
H. D. Vinod.
Econometrica, Vol 36, No 2, pp 322-336, April 1968. 15 p, 1 fig, 2 tab, 19 ref.

Descriptors: Least squares method, Regression analysis, Forecasting, Joint costs.
Identifiers: *Econometrics, *Joint production, Canonical analysis, Ordinary least squares, Ratio elasticity, Production function.

It is argued here that in the presence of joint production, ordinary least squares regression, OLS, gives inconsistent estimates. An alternative estimation procedure is therefore developed. The application of the tool of canonical correlation analysis for econometric problems has so far been rather limited because of various problems. An attempt is made in the first part of this paper to extend the analysis in order to handle a greater variety of problems. A new way of looking at the canonical variables is suggested while developing an estimation technique for joint production functions. In the second part, empirical examples and a comparison with OLS are included. The forecasting accuracy is also compared, illustrating the superiority of the suggested estimation procedure. The 'production' of water may involve the joint product situation described in this article. The implications for the regression estimates when this is the case for the water good can be thought of as identical to the general case this paper discusses. (Loeb-Rutgers)
W69-04070

WHAT KIND OF REDISTRIBUTION DO WE WANT,
London School of Economics and Political Science (England); and Virginia Univ., Charlottesville.
James M. Buchanan.
Economica, New Series Vol XXXV, No 138, pp 185-190, May 1968. 6 p, 1 fig.

Descriptors: Resource allocation, *Taxes.
Identifiers: *Individual preference function, Income distribution, *Income transfers, Numeraire, Externality, Welfare surface.

In his papers (Economica, Feb. and May, 1967), Foldes examined redistribution in specific goods and services in a normative context. As Foldes suggests economists should pay more attention to this type of redistribution, as opposed to redistribution in general purchasing power, but this shift of emphasis can be justified on positive grounds. The hypothesis suggested here is that individuals desire the removal of certain specific behavioral results of poverty, not the equalization of incomes. Advocates of the negative income tax have failed to recognize this. The redistribution aspects of water projects have recently attracted research attention and accordingly this paper has suggested an approach to examine redistribution phenomena in a non-normative manner. (Sokoloff-Rutgers)
W69-04075

WHAT REDISTRIBUTION MAY ECONOMISTS DISCUSS,
London School of Economics and Political Science (England).
Kurt Klappholz.
Economica, New Series, Vol XXXV, No 138, pp 194-197, May 1968. 4 p.

Descriptors: *Resource allocation, Optimization, Ethics.
Identifiers: *Criterion, Individualistic, Social welfare function, *Hypotheses, *Normative.

This note criticizes the view of J. M. Buchanan, expressed in the same issue of Economica, that economists must not incorporate 'external norms' in their models. The author contends that Buchanan confuses two senses of 'norms': 'norms' in the snese of hypotheses concerning the preferences of individuals whose behavior is to be explained, and 'norms' in the sense of criteria for appraising economic arrangements. While there are methodological arguments against using 'external norms' in the sense of hypotheses, there are none against using 'external norms' in the sense of criteria. Water projects involving redistribution of income problems are relevant to this article. (Sokoloff-Rutgers)
W69-04076

OPTIMAL TIMING OF INNOVATIONS,
Washington Univ., Seattle.
Yoram Barzel.
Rev Econ and Stat, Vol 50, No 3, pp 348-355, August 1968. 8 p, 3 fig, 2 tab.

Descriptors: Timing, Benefits, Growth rates, Costs.
Identifiers: *Optimal timing, *Innovations, Pareto optimal, Technical change, Profit maximization.

When an economy expands, potential innovations progressively become more profitable, since the resource costs of developing an innovation are constant whereas the returns increase directly with the output of the commodity affected by the innovation. Profit maximization, however, does not guarantee optimal allocation of resources over time. On the one hand, the inability of innovators to capture all the benefits will cause a delay in innovating activity; alternatively, competition between potential innovators as to who will reach the market first will cause a premature application of resources to innovations. These two forces, in general, will not cancel each other. Under certain extreme conditions the net economic value of the innovation will be zero. Only when the innovator can exclude others from innovating and when all the benefits will accrue to him will the timing of the innovation activity be Pareto optimal. If an innovation is optimally timed, its net present value per unit of innovation investment will be $P/(r - p)$ where P is the rate of growth in the output of the commodity affected by the innovation and r is the rate of discount in the economy. Potential theoretical extensions of this article to water resources involve the timing of the introduction of new water technology as it effects Pareto efficiency conditions with the quantity of investment, need for governmental intervention and resource allocation problems also involved. (Loeb-Rutgers)
W69-04081

INVESTMENT BEHAVIOR AND NEO-CLASSICAL THEORY,
Northwestern Univ., Evanston, Ill.; and National Bureau of Economic Research, New York.
Robert Eisner, and M. I. Nadiri.
Rev Econ and Stat, Vol 50, No 3, pp 369-382, August 1968. 14 p, 6 tab, 13 ref, 1 append.

Descriptors: Prices, Investment, Capital.
Identifiers: *Investment behavior, *Neo-classical theory, Elasticity of capital stock, Relative prices, Output, Replacement.

Key propositions of Jorgenson's, 'theory of investment behavior based on the neo-classical theory of optimal accumulation of capital' are tested with post-war, quarterly time series data for manufacturing. These include Jorgenson's assumptions derived from the Cobb-Douglas production function that elasticities of capital stock, K, with respect to relative prices, P/C, and output, Q, as well as their product PQ/C, are all unity. Instead of constraining the elasticities to be unity, as Jorgenson does, the authors estimate them freely with general Pascal distributed lag estimators. The best estimates of the elasticity of capital stock with respect to PQ/C, which in Jorgenson's formulation is proportional to 'desired capital stock,' are then found to be less than .25, and significantly less than unity. The elasticity with respect to relative prices alone, even under the most favorable definition, are in the neighborhood of .16. The elasticity with respect to output is considerably higher, varying downward from .82. These results offer little support for Jorgenson's particular 'neo classical' explanation of investment. Other conclusions of Jorgenson and associates are shown to be derived from special assumptions of Jorgenson's model and to be unsubstantiated or contradicted by the data. Equivalent issues in treatments of water resource investment can use this article as a framework for the water investment problem. (Loeb-Rutgers)
W69-04082

ON THE PRINCIPLE OF CONSUMERS' SOVEREIGNTY,
California Univ., Berkeley.

Tibor Scitovsky.
Amer Econ Rev, Vol LII, No 2, pp 262-268, May 1962. 7 p.

Descriptors: Prices, Taste.
Identifiers: *Consumer sovereignty, *Collective goods, Social security, Health insurance, Innovation, Value judgments.

This paper concerns two issues, the choice between market and collective goods, and the problem of whether the market can cater to consumer's tastes truly and well. The author believes that the American public has a bias against collective goods which even prevents its forming and expressing rational preferences on the economic aspects of any choice involving them. However, crowding, increased life expectancy, secular inflation, uneven progress and the resulting change in relative prices call for a reconsideration of the question of which goods and services should be provided collectively and which through the market. Given present control of man over his fellow man's beliefs, should consumers' preferences still be considered as datum, and even by this questionable standard the market economy performs badly for reasons not even considered in traditional analysis. The provision of water resources as a public good involving collective consumption decisions can be placed in the context of problems raised in this article. (Sokoloff-Rutgers)
W69-04083

ECONOMIC THEORY AND THE MEANING OF COMPETITION,
Columbia Univ., New York.
Paul J. McNulty.
Quart Jour Econ, Vol LXXXII, No 4, pp 639-656, Nov 1968. 18 p.

Descriptors: *Competition, *Monopoly, *Costs.
Identifiers: Uncertainty, Inefficiency, Allocative efficiency, Economic growth, *Market structure production techniques.

Competition entered economics as a concept which had empirical relevance and operational meaning in terms of contemporary business behavior. Yet today with such common current practices as advertising and product variation, this usual definition of competition has allowed us to avoid defining this concept, as distinct from the concept of competitive market, in a way relevant and adequate both for economic analysis and economic policy. It is one of the great paradoxes of economics that every act of competition on the part of a businessman is taken as evidence, in theory, of some degree of monopoly power. Perfect competition, the only clearly and rigorously defined concept of competition found in economic theory means simply the existence of an indefinitely large number of noncompeting firms. There was an unfortunate merging of the concepts of competition and the market. Competition was never related in any systematic way to the technique of production or the organizational form of the firm itself. Also this concept has never been related in a systematic way to costs of production. A new dimension has been suggested in recent years in the various efforts to develop a 'behavioral theory' of the firm. The general aspects of competitive behavior as it applies to the 'water industry' are the broad topics treated by this article which can be conceived as relevant to study in the water area. (Sokoloff-Rutgers)
W69-04084

REVISITING MARSHALL'S CONSTANCY OF MARGINAL UTILITY OF MONEY,
Vandervilt Univ., Nashville, Tenn.
Nicholas Georgescu-Roegen.
Southern Econ Jour, Vol XXXV, No 2, pp 176-181, Oct, 1968. 6 p, 3 fig.

Descriptors: Income, Prices, Demand, Expenditures.
Identifiers: *Consumers' surplus, *Quasi-constancy, Utility structure, *Marginal utility, *Money, Consumer budget.

This paper aims to show that it is possible to vindicate the constancy of marginal utility assumption of Marshall at least for his intuition of the economic reality of which he was a witness. The argument is based upon two omissions in the previous indictments of Marshall. The first omission concerns the fact that Marshall held that the marginal utility of money is quasi-constant and not a constant in the mathematical sense. The second concerns the fact that these indictments implicitly assume that the utility structure is such that in absolutely any situation the optimal budget includes every commodity available on the market. Marshall may not have intended to construct a theory applicable to all conceivable situations and there are good reasons in support of the view that the assumption of quasi-constancy of marginal utility of money fits an important category of incomes, the middle class incomes. Also Marshall's dream was to provide economics with concepts directly useful to numerical analysis even at the price of heroic simplification. Water recreation studies often utilize the area under the demand curve as a benefit measure. The constant utility of money assumption is vital to the correct measurement of this area and thus this article has relevancy to water studies using this approach. (Sokoloff-Rutgers)
W69-04086

A NOTE ON THE GLOBAL STABILITY OF A SIMPLE GROWTH MODEL WITH MANY CAPITAL GOODS,
Pennsylvania Univ., Philadelphia; Harvard Univ., Cambridge, Mass; Chicago Univ., Ill., and Osaka Univ. (Japan).
Edwin Burmeister, Rodney Dobell, and Kiyoshi Kuga.
Quart Jour Econ, Vol LXXXII, No 4, pp 657-665, Nov, 1968. 9 p.

Descriptors: Investment, Rent, *Stability.
Identifiers: *Capital goods, Dynamic efficiency, *Capital gains, Asset prices, *Balanced growth, Solow model.

This paper analyzes a model which is, in a sense, a multigood version of Solow's simple model. Its local stability was demonstrated by Burmeister and Dobell; the present analysis proves the global stability. The model supposes an institutional environment in which services of capital goods are rented, like those of labor. The point of the model is that it does permit any number of different capital goods, but assumes investment decisions independent of capital gains anticipated on resale equipment. The model is globally stable, converging to an unique balanced growth equilibrium path. The paper has theoretical relevancy to treatments of water investment functions and water production functions where water has multi-purpose users (i.e. water is a multi-good). (Sokoloff-Rutgers)
W69-04087

THE DUAL IN NONLINEAR PROGRAMMING AND ITS ECONOMIC INTERPRETATION,
City Univ. of New York; and Princeton Univ., N. J.
M. L. Balinski, and W. J. Baumol.
Rev Economic Studies, Vol XXXXV, No 103, pp 237-256, July 1968. 20 p, 11 fig, 15 ref.

Descriptors: Return to scale, *Linear programming, Optimization, Profit, Rent, Alternative costs.
Identifiers: Separating hyperplane theorem, *Nonlinear programming, *Dual problem, *Shadow prices, Lagrange multiplier, Capacity.

This article describes how the notion of duality can be extended to nonlinear programs, satisfying the appropriate concavity-convexity conditions. It provides a definition of this duality and describes its motivation. Several fundamental theorems are stated and proved, including the interpretation of the dual variable as a marginal input yield. The dual constraints are shown in economic terms to be the precise counterpart of those in linear programming, with marginal values substituted for average values throughout. The nonlinear objective function is shown to include, in addition to the value of the inputs, a set of terms corresponding to economic rents. The difference can be explained in terms of the 'adding up controversy' of distribution theory and its resolution in terms of linear homogeneous production functions. A graphic interpretation of the linear and nonlinear dual programs is also provided. This paper has relevancy to water production problems which utilize both linear and nonlinear constraints and objective functions. (Sokoloff-Rutgers)
W69-04088

CONTINUOUS AND DISCRETE TIME APPROACHES TO A MAXIMIZATION PROBLEM,
Chicago Univ., Ill.
L. G. Telser, and R. L. Graves.
Review Economic Studies, Vol XXXV, No 103, pp 307-325, July 1968. 19 p, 10 ref, 1 append.

Descriptors: *Dynamics, *Monopoly, *Time, Interest rate, Investment, Demand, Mathematical models, Capital, Prices, *Stability, *Growth rates.
Identifiers: *Discrete, *Continuous, Present value, Maximization, Coefficients, *Difference equations, *Differential equations.

This paper deals with a class of economic problems in which a firm seeks a maximum present value of its return over an infinite horizon at a given interest rate. The problem has two versions. The main concern is with a monopolist who seeks a present-value-maximizing sales policy in the face of a given demand function such that quantity demanded depends linearly on past and expected future prices. In the second version a firm determines its stock of capital over time so as to maximize the present value of its net return. Surprising differences appear for a given model in discrete and in continuous time. For example, in the monopoly problem a solution exists in continuous time if there is an upper limit on the discount rate while in the discrete version a solution exists for all discount rates above a lower limit. This paradoxical result as well as other differences between continuous and discrete time approaches have important economic interpretations in terms of treatment of expectations and uncertainty implicit in these two approaches. Dynamic problems of pricing and maximizing rate of return as it applies to 'water producers' are the relevant extensions of this article to the water area. (Sokoloff-Rutgers)
W69-04091

THE PLANNING-PROGRAMMING-BUILDING-BUDGETING SYSTEM,
Harvard Univ., Cambridge, Mass.
Arthur Smithies.
Am. Economist, Vol 12, No 1, pp 7-12, Spring 1968. 6 p.

Descriptors: *Decision making, *Planning, Budgeting, Cost-benefit analysis, Governments, Federal Government.
Identifiers: *Planning-Programming-Budgeting System, United States Department of Defense, Public goods.

The Planning-Programming-Building-Budgeting System is essentially an application and extension of the economics of choice to public decision making. It assumes that explicit choice among alternative courses of action leads to more rational decisions than other methods of decision making. PPBS is not a method of reaching definite conclusions. It is a method organizing discussion and marshalling evidence in a way that will lead to an effective advocacy procedure. Most economic theory and operations analysis start with the assumption of a given preference function or objective function and seek an optimum situation under it. However, within a broad general context, the objective function itself must be articulated and refined as part of the decision-making process. Government decision makers must be aware of the continual interaction between ends and means. The process of determining goals and deciding on methods of attaining

them are part of the same process. The public good problems of water resources involving budget expenditures, social objectives, and alternative outlets of public funds can be considered as the relevant issues in water research that are treated in this paper. (Winn-Rutgers)
W69-04092

EMPIRICAL EVIDENCE ON THE ACCELERATION PRINCIPLE: A COMMENT,
A. G. Hines.
Rev Econ Studies, No 103, pp 347-49, July 1968. 3 p.

Descriptors: Capital, Investment.
Identifiers: *Acceleration principle.

This note points out that the capacity formulation of the acceleration principle fails to meet one of the two major criticisms of the principle since it does not take into account gestation lags which cause a discrepancy between planned and actual investment in any given period. It shows that the simple distributed lag version, which is identical to the capacity formulation given the assumption that investment plans are always realized within the unit period, also suffers from the same defect. On certain assumptions the capacity version of the acceleration principle is empirically indistinguishable from other hypotheses. Thus, although Smyth has refuted the view that statistical evidence is invariably unfavorable to the acceleration principle, the evidence which he adduces in its support is also consistent with other hypotheses. This article is relevant to attempts at theoretical (or empirical) treatments of the aggregative impacts that water investment expenditures have on the economy via an accelerator analysis. (Winn-Rutgers)
W69-04096

SOME EFFECTS OF TAXES ON RISK TAKING,
Stockholm Univ., (Sweden).
B. Naslund.
Rev Econ Studies, Vol 35, No 103, pp 289-306, July 1968. 18 p, 9 fig, 21 ref.

Descriptors: *Taxes, *Risks, Investment, Decision making.
Identifiers: Proportional taxes, Utility analysis, Chance-constrained programming.

Since there are several formulations of stochastic programming under risk in the literature, it is of interest to include taxes in such models in order to find their effect on risk taking. Thus, a major part of the paper is concerned with the chance-constrained programming formulation of the decision problem under risk. This formulation maximizes the expected value of the criterion function subject to probabilistic constraints indicating the risk that the decision maker is willing to take. It is shown that if an investor holds some part of his assets in the form of money, then he will hold the risky assets in fixed proportions that are independent of his wealth and of his utility function. It is also shown that when an investor holds risky and non-risky assets, then a linear tax will increase risk taking. Water problems involving risk and their possible solutions via stochastic programming are potential water oriented applications of the users discussed in this article. (Winn-Rutgers)
W69-04097

MEGALOPOLIS: RESOURCE CONSERVER OR RESOURCE WASTER,
Duke Univ., Durham, N. C.
Joseph J. Spengler.
Natural Resources Journal, Vol 7, No 3, pp 376-395, July 1967. 20 p.

Descriptors: *Natural resources, Efficiencies, *Population, Stochastic processes, Productivity, Agriculture, Pollutants.
Identifiers: Leisure, *Traffic, *Parking space, Living space, Social costs, Megalopolis, *Optimum size.

This article indicates certain major disadvantages which become more intense as city size increases. Furthermore, it may be inquired whether technological and economic trends are making, as are changes in tastes, for greater urban population concentrations and city size, or for smaller ones. There are as yet no clear-cut answers to this question, but at least three indications seem to be emerging. First, optimum plant size appears to be decreasing somewhat as a result of automation. Second, improvements in systems of communication and in managerial practice probably are reducing the economies associated with the location of several plants in the same community. Third, the relative importance of manufacturing is declining and that of services is rising; as a result a larger fraction of the labor force is now free to locate at will than was true in the past. Should these trends materialize, some dispersal to smaller cities may result. However, urban growth could be given a more rational direction by imposing sufficient taxes upon business undertakings to insure their continuing self renewal and by imposing taxes at progressively higher rates when cities exceed a stipulated size. Urban water issues are among the general problems that this article discusses. (Sokoloff-Rutgers)
W69-04098

METROPOLITAN RESOURCES IN A POLICY MATRIX,
State University of New York, Albany.
Richard J. Kalish, and Donald J. Reeb.
Natural Resources Journal, Vol 8, No 3, pp 505-509, July 1968. 5 p, 1 fig.

Descriptors: Resources, Urbanization, *Community development, Taxes.
Identifiers: Megalopolis, Matrix of Regional Policy Tools.

Spengler has asked if we have reached a point in our larger cities where the diseconomies associated with existent or continued agglomeration outweigh possible economies. Spengler points out that the majority of urban growth-affecting decisions are made by individual decision makers who are primarily concerned with making economic profits. Since private business investment decisions are the most powerful of these decisions, taxes on business can be used to aid rational city growth. This article shows that this policy has certain weaknesses--those associated with defining the locus of taxes, the concept that taxes can be effectively used as penalty instruments and the implication that regional development strategies depend upon tax expenditures for effectuation. Alternative economic tools for regional development are illustrated by the Matrix of Regional Policy Tools. Regional water development issues of taxation, benefits, and expenditures are relevant to the issues raised in this paper. (Winn-Rutgers)
W69-04099

MEGALOPOLIZATION AND LEISURE: A COMMENT,
George Washington Univ., Washington, D. C.
Justin Voss.
Natural Resources Journal, Vol 8, No 3, pp 510-512, July 1968. 3 p.

Descriptors: Time, *Urbanization, Resources, Resource allocation, Supply.
Identifiers: *Leisure, Megalopolization, Discretionary time, Aggravation effect.

Spengler has implied that time and space are complementary goods. In this comment, the author notes that Spengler's analysis of time and space centers primarily on demand. However, the cause-effect relationship on the supply side appears more relevant in assessing the availability of the time resource within the megalopolis. By Spengler's definition megalopolization means a reduction in urban space per capita. As the supply of space declines, general congestion increases and creates an aggravation effect. Here the familiar problem of urban traffic congestion is generalized to include the waiting involved in all activities. Whether or not the megalopolis proves to be a resource waster or resource conserver depends primarily upon whether the responses to the aggravation effect are moving the society toward or away from an optimal use of resources. If the costs (time and other) of megalopolization are outrunning the benefits (multiplicity of choice) a rational society at some future date may demand alternative patterns of social and economic organization. Urban water problems fit into the general orientation of this paper with implications for water benefit-cost analyses. (Winn-Rutgers)
W69-04100

A TRANSFORMATION USED TO CIRCUMVENT THE PROBLEM OF AUTOCORRELATION,
University of Western Ontario, London.
Koteswara Rao Kadiyala.
Econometrica, Vol 36, No 1, pp 93-96, January 1968. 4 p, 9 ref.

Descriptors: Markov processes, Regression analysis, Efficiencies.
Identifiers: Transformation, *Autocorrelation, Autoregressive process.

In this paper it is shown that, when the disturbances epsilon sub t = y sub t - the sum of (X sub tj) (beta sub j) from j = 1 to K in a regression model follow a first order autoregressive process with the parapeter p generating the process, there exist cases where the classical least squares regression analysis is applied to the n-1 observations: y sub t - py sub t-1, x sub tj - px sub t-1, j (j = 1, 2, ... , K; t = 2, ... , n), is less efficient than the classical least squares regression analysis as applied to the original n observations: y sub t, X sub tj (t = 1, ..., n). It is shown that the efficiency of the former could be arbitrarily close to zero in some cases. Water simulation studies often involve autoregressive stochastic terms and the conclusions of this article are relevant to empirical water studies where this problem arises. (Loeb-Rutgers)
W69-04101

PARAMETERS AND RELATIONS OF STOCHASTICALLY LAGGED AND DISAGGREGATIVE TIME SERIES,
Northwestern Univ., Evanston, Ill.
Haskel Benishay.
Econometrica, Vol 36, No 1, pp 155-171, January 1968. 17 p, 8 ref.

Descriptors: Stochastic processes, *Time series analysis, Inflow.
Identifiers: Parameter, Stock, Outflow, Stochastic lag, Random number, Subcomponent, Serial correlation.

A new approach is employed to construct the first of several models to describe a process consisting of three related time series; an inflow, a stock, and an outflow. The inflow, stock, and outflow series are related via a stochastic lag applicable to subcomponents of the inflow series. All three series are viewed as cumulations of a random number of subcomponents of randomly determined size. The exogenous variables of this model are (1) the number of subcomponents of the inflow, (2) the size of a subcomponent, (3) the life of a subcomponent. In this first model these exogenous variables are assumed naturally independent during an interval or a point in time and serially independent over time. In subsequent analyses some of these independent assumptions are relaxed. Among the interesting results are some relevant serial and cross serial correlations of the time series under consideration. These relations and others make it possible to evaluate the comparative advantage of lead series in forecasting lag series, and as such may be of value for the evaluation of stabilization policies. The model may be viewed as a description of several inflow-stock-outflow phenomena. This article is relevant to water simulation studies involving use of water flows, stocks and flow forecasts. (Loeb-Rutgers)

W69-04102

THE DECOMPOSITION OF ECONOMIC PRODUCTION SYSTEMS,
Chicago Univ., Ill. School of Business.
Roman L. Weil, Jr.
Econometrica, Vol 36, No 2, pp 260-78, April 1968. 19 p, 22 ref.

Descriptors: Input-output analysis, Leontief models.
Identifiers: *Production systems, *Decomposition, Tearing, Goods, Processes, Subeconomies, Decomposable economy, Equivalence classes.

Economic production systems may break up into subeconomies of goods and processes that can function independently of each other. This article first explores the various kinds of decompositions that may exist in production schemes, nonlinear as well as linear. Some recent techniques developed in graph theory are adopted to ascertain the decompositions possible for a given production system and the precedence relations between the subeconomies of the decomposition. Finally, it is shown how the concept of 'tearing' from simultaneous equations theory might be used to analyze square input-output models for potential decompositions. The integration of water into a general model of the interrelations among the various producing sectors of the economy is a useful extension of this article to the water resource area. (Loeb-Rutgers)
W69-04103

A NOTE ON PUBLIC GOODS SUPPLY,
Virginia Univ., Charlottesville; and Florida Univ., Gainesville.
James M. Buchanan, and Milton Z. Kafoglis.
Amer Econ Rev, Vol LIII, No 3, pp 403-414, June 1963. 12 p, 3 fig, 7 ref.

Descriptors: Equilibrium.
Identifiers: *Externality, *Pareto optimality, Marginal conditions, Payoff matrix, *Resource inputs, Game theory, *Non-reciprocal.

Independent or market organization of an activity that is acknowledged to embody relevant external economies need not result in an under-supply of aggregate resource inputs, relative to that amount required to satisfy the necessary marginal conditions for Pareto-optimality. In the first model where non-reciprocal external economies are present, it is necessary to distinguish between units of resources supplied and units of final output that may be consumed. The direct relationship between inputs and outputs is modified when some inter-personal substitutability in consumption is allowed. The word 'economies' suggests that a greater quantity of final output can be achieved with a given quantity of resource inputs when these economies are exploited. In the case of reciprocal externality there is a smaller total outlay on the service with either a larger or smaller total quantity being consumed. Insofar as the utilization of inputs is characterized by relevant external economies which stand in a substitute relationship the individual can under cooperative or collective arrangements, in one sense, 'purchase' the consumption of others. The public good aspect of water resources makes this article applicable to theoretical investigations of the externality issues of water. (Sokoloff-Rutgers)
W69-04104

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

EARMARKED TAXES AND MAJORITY RULE BUDGETARY PROCESS,
Virginia Polytechnic Inst., Blacksberg, Va.
Charles J. Goetz.
American Econ Rev, Vol 58, No 1, pp 128-136, March 1968. 9 p, 2 tab, 10 ref.

Descriptors: *Taxes, Government finance, Budgeting, Political aspects, Financing, Welfare economics.
Identifiers: *Earmarked taxes, Majority rule, *General funds budgeting.

Under certain conditions, the only possible budgetary adjustments which yield majority gains may require logrolling between members of the majority coalition on tax adjustment. General funds budgeting is a suboptimization process which renders cooperation between faction unlikely. By contrast, earmarking provides an enforceable 'tie-in' between tax concessions and expenditure concessions which may be necessary to construct a tax-and-expenditure package with net benefits for a majority of the voters in the budgetary process. The welfare implications of earmarking must be interpreted with caution since majority gains must be compared with minority losses. However, it is possible to explain earmarking's common usage as a perfectly rational device for coalition formation in a budgetary model where preference conflict exists. Important issues involving the relation of taxation, benefits and budget expenditures for water resource development are involved in the extension of this article to water studies. (Winn-Rutgers)
W69-04067

A SIMPLE MACROECONOMIC MODEL WITH A GOVERNMENT BUDGET RESTRAINT,
Johns Hopkins Univ., Baltimore, Md.
Carl F. Christ.
Jour Pol Econ, Vol 76, No 1, pp 53-67, Jan/Feb 1968. 15 p, 4 tab, 8 ref.

Descriptors: Equilibrium, Budgeting, Expenditures, *Tax rate.
Identifiers: Money issue, Monetary policy, High powered money, *Budget restraint, *Fiscal policy *Multiplier effect.

There is a government budget restraint, which requires that in each period total government expenditure (transfers plus purchases of goods and services) be equal to the total flow of financing from all sources (including fiat money). This is a constraint upon the government's freedom to choose arbitrary values of such policy variables as expenditures, taxes, net amount of new money issued, and net amount borrowed from the private sector. The government budget restraint is introduced into a simple theoretical static macroeconomic model of aggregate demand with a rigid price level to show how the analysis of macroeconomic policies is affected by the budget restraint. It is shown that the multiplier effect of a change in government purchases cannot be defined until it is decided how to finance the purchases. The one-year impact multiplier effect and the long-run multiplier effect of government purchases may be greater or less than the value obtained by ignoring the budget restraint, depending upon the method of financing. This article has relevance for governmental expenditure decisions in water resources. (Sokoloff-Rutgers)
W69-04069

A NOTE ON THE SYMMETRY BETWEEN BRIBES AND CHARGES,
Purdue Univ., Lafayette, Ind.
Charles R. Plott, and Stuart Mestelman.
Water Resources Research, Vol 4, No 1, pp 195-197, February 1968. 3 p, 3 ref.

Descriptors: Taxes.
Identifiers: *Symmetry, *Bribes, *Charges, Bribe method, *Externalities, Optimum output, Asymmetries.

It has been argued that within a dynamic setting, without complete information, the tax and bribe methods of correcting externalities give asymmetrical results. A model is presented which shows that the bribe under such conditions yields optimal results, whereas the tax alternative does not. This conclusion is the opposite of that drawn from other models advanced in the literature. It cannot be said that within such a setting one policy is better than the other, since all such conclusions depend upon the particular characteristics of each model. The problems of externalities and individual compensation in water resources are an oft-cited defense of the public-good aspect of water. This article has relevancy to theoretical treatments of compensation and taxation in water resources that generate externalities. (Loeb-Rutgers)
W69-04071

INCOME DISTRIBUTION AND GROWTH IN A MONOPOLIST ECONOMY,
Osaka Univ., (Japan).
Hiroshi Atsumi, and Hukukane Nikaido.
Zeitschrift Fur Nationalokonomie, Vol 28, No 3-4, pp 399-416, Aug-Dec 1968. 18 p, 7 fig, 3 ref.

Descriptors: Stability, *Labor supply, Capital supply, *Wages.
Identifiers: *Income distribution, *Steady growth state, Production function, Partial equilibrium analysis, Interdependence.

In sharp contrast to our fairly satisfactory knowledge about the mechanisms of income distribution under competitive pricing, there is no competent counterpart knowledge about noncompetitive situations. One reason for this may be that it is generally difficult to obtain a well-posed interrelations between all economic agent's shares to national income in a noncompetitive situation. In order to build a theory of income distribution in a noncompetitive economy, it is necessary either to explore the submerged part of the existing oligopoly theory--the interdependence of the relevant perceived demand functions or to invent alternative constructions replacing demand and supply functions. There is an exceptional case which can be met with the existing analytical machinery. This is the counterpart case under monopolistic pricing of the Solovian neoclassical growth. The principle concern of the paper is to consider income distribution and growth in this counterpart situation, including comparison of the long-run equilibrium real wage rate under monopolistic pricing and under competitive pricing. Pricing, distribution and supply problems in the non-competitive water industry are the implicit theoretical problems involved in this paper for water resources. (Sokoloff-Rutgers)
W69-04072

A NOTE ON A LOCATION PRINCIPLE,
Hunter College, New York.
Peter C. Rydell.
Journal of Regional Science, Vol 7, No 2, pp 185-192, Winter 1967. 8 p, 1 fig, 4 ref, append.

Descriptors: *Sites, Costs, *Pricing, Discriminatory pricing, Profits.
Identifiers: *Location principles, Delivery costs, Uniform delivered pricing, F.O.B. pricing, Principle of median location.

The principle of median location states that to minimize delivery costs a manufacturer must locate at the median of the distribution to his customers. When the delivery cost function is not linear or when consumers buy unequal amounts of the manufacturer's product, the principle of median location fails to apply. In a linear region with a unimodal distribution of consumers, a concave delivery cost function makes a manufacturer's optimal location lie between the median and mode of the distribution of consumers. This 'between the median and mode' location principle applies to three types of location problems: (1) locating to minimize the costs of distributing an equal amount of the product to each consumer in the region; (2) locating to maximize profits under a policy of spatial price discrimination; and (3) locating to maximize profits after choosing between uniform delivered and F.O.B. pricing. The relation of water cost to physical distance makes this article relevant to water pricing and supply problems. (Winn-Rutgers)

W69-04095

THE LONG-RUN COST FUNCTION OF WATER PRODUCTION FOR SELECTED WISCONSIN COMMUNITIES,
Dartmouth Coll., Hanover, N. H.
Lawrence G. Hines.
Land Economics, Vol 45, No 1, pp 133-140, Feb 1969. 8 p, 1 tab, 8 ref.

Descriptors: *Statistical methods, Least squares method, Surface waters, Subsurface waters.
Identifiers: *Wisconsin, Time-series analysis, *Cross-sectional analysis.

The empirical measurement of long run costs involves either: (1) time series analysis of single firm; or (2) cross-sectional analysis of a number of various sized firms in a given time period. The inability to measure size is a serious deficiency in the long-run study. The technology of today's water production is similar to that of fifty years ago. Water produced from an underground supply involves larger pumping and drilling costs, while treatment and reservoir costs are usually more important in water from surface sources. The production and distribution of water involves the collection, treatment, and distribution of water. The greatest diversity of unit cost is in the distribution of water. This study compiled a series of regression equations on cost-capacity-output of Wisconsin water production. The analysis was of cross-sectional data. The conclusion states that the general hypothesis of constant cost in surface water production is statistically rejected. (Grossman-Rutgers)
W69-04136

DYNAMIC PROGRAMMING FOR PROJECT COST-TIME CURVES,
California Univ., Los Angeles.
William S. Butcher.
Proc Amer Soc Civil Eng, Vol 93, No CO1, pp 59-73, Mar 1967. 15 p, 11 fig, 4 tab, 7 ref.

Descriptors: *Dynamic programming, Decision making, Cost allocation, *Project planning, Computer programs, Networks, Time, Optimization, Critical path method.
Identifiers: Time-cost function.

A dynamic programming approach was used to solve for the minimum project time versus total cost function, when the project was completed in sequential operations with each operation having an independent time-cost function. The decision variables were the amounts of money allocated to each stage of the project. A hypothetical three-stage project was solved in tabular form. The logic flow diagram for the computer program was shown. The method for simplifying parallel loops in a planning network so that the dynamic programming method can be applied was described, and a hypothetical example solved. It was concluded that the technique was applicable to simple project planning networks without inverval cross-connections. (Gysi-Cornell)
W69-04137

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06D.
For abstract, see .
W69-04145

OPTIMAL WATER QUALITY MANAGEMENT AND MULTI-COMPONENT EFFLUENT CONTROL BY MEANS OF LINEAR PROGRAMMING,
For primary bibliographic entry see Field 05D.
For abstract, see .
W69-04147

VERTICAL ALIGNMENT OF SEWER AND DRAINAGE SYSTEMS BY DYNAMIC PROGRAMMING,
Massachusetts Inst. of Tech., Cambridge, Mass.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-04150

6D. Water Demand

MEETING TOMORROW'S ELECTRIC POWER NEEDS--NEW METHODS, NEW CONCEPTS,
Pacific Gas and Electric Co., San Francisco, Calif.
Robert H. Gerdes.
Pap, World Power Conf, Aug 1968. 19 p, 3 fig, 2 ref.

Descriptors: *Electric power, Peak power, Thermal power, Magnetohydrodynamics, *Electric power demand, *Electric power production, Electric power costs, Cooling water, Nuclear energy, Radioactivity, Research and development, Magnetic fields.
Identifiers: Fuel costs, Fossil fuels, *Thermoelectric generators, *Electrogasdynamics, Nuclear power, Geothermal powerplants.

The United States' electric power industry must increase 6-fold in the next 32 yr to meet the expected growth in electric energy use. To assure the soundest possible basis for the continued growth of the industry, new methods and concepts for power generation are being investigated. Nuclear power is dominating the industry's plans for new generation, and new methods are being developed. Nuclear magnetohydrodynamic (MHD) generators may require extensive development in reactors. Fossil-fueled MHD generators may be close to reality and appear economically attractive for peaking. Electrogasdynamic (EGD) generators would require virtually no cooling water and, theoretically, should have high thermal efficiencies, but the application of EGD generators to power systems awaits the development of an efficient EGD generator. Geothermal generation using natural steam from wells is an excellent power source in those limited areas where it is available. The United States' electric power industry is confident that it can provide reliable low-cost electricity to meet the growing needs of society with the methods discussed and with methods not yet conceived. (USBR)
W69-03770

LONG-RANGE HYDROELECTRIC POWER USE DESCRIBED,
A. A. Beschinskiy, and A. A. Borovoy.
Joint Publ Res Serv, Pap 46559, Sept 1968. 19 p, 4 tab.

Descriptors: *Long-term planning, Planning, *Hydroelectric power, Hydroelectric plants, *Multiple-purpose projects, Irrigation, Economics, Flood control, River regulation, Natural resources, Thermal power, River basin development, Electric power production, Foreign countries, Costs, Electric power demand, Transmission (Electrical), Electric power costs.
Identifiers: *Hydroelectric resources, *USSR, Load centers, Power system stability.

The planned use of the enormous hydropower resources is a major factor in creating and developing a large power base in the USSR and in the consistent and effective electrification of the national economy. The nation's potential and developed hydropower is reviewed, and problems of the dependability and stability of large interconnected systems discussed. Demands for water control and water power engineering in the USSR are being solved by building cascades of reservoirs to rationally regulate, and on lower reservoirs, reregulate river runoff in the best interests of all participants. Multiple-purpose projects and long-distance transmission of power from remote hydroelectric sites to industrial areas are considered in the power planning economy. (USBR)
W69-03780

WATER AND CHOICE IN THE COLORADO BASIN,
National Academy of Sciences-National Research Council, Washington, D. C. Committee on Water.
Gilbert F. White.
Nat Res Counc, Publ 1689, Washington, D. C., 1968. 107 p, 7 fig, 2 tab, 76 ref.

Descriptors: *Water resources, *Colorado River Basin, Colorado River, *Water management (Applied), *Arizona, Water conservation, Water costs, Water law, Arid lands, Water quality, Water policy, *Water, *Water shortage, Water transfer, Water utilization, Economics, Water resources development, Economic efficiency, Bibliographies.
Identifiers: *Substitutes, National Research Council, Committee on Water, *Regional planning, Water plans, *Water resources management.

The Committee on Water of the National Research Council gives its attention principally to water problems and management in the Colorado River Basin as a means of providing a concrete example of the general suggestions presented in their earlier report, 'Alternatives in Water Management.' Water management is only one of the major fields where a substantial investment may prove beneficial to a regional economy. For purposes of illustration in this context, the Committee has chosen the State of Arizona. Chapter 5 is devoted to several alternative fields for investment in regional economic development that could be at least equally beneficial. This chapter suggests that the choice with respect to water management programs is in 2 dimensions: (1) between water programs and other programs, and (2) between alternative water management programs. Chapter headings for other areas of discussion include: Problems of Water Supply in the Basin, The Range of Objectives in Planning for the Use of Colorado Water, and On the Enhancement of Choice. (USBR)
W69-03785

LAW OF THE RIVER,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03801

ALLOCATIONS, DIVERSIONS, AND RELEASES.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-03920

WATER REQUIREMENTS OF THE IRON AND STEEL INDUSTRY,
Geological Survey, Washington, D. C.
Faulkner B. Walling, and Louis E. Otts, Jr.
Geol Surv Water-Supply Pap 1330-H, pp 341-394, 1967. 53 p, 4 fig, 1 plate, 8 tab, 86 ref.

Descriptors: *Water requirements, *Industrial water, *Thermal pollution, Water cooling, Intakes, Mine wastes, Water consumption, Water utilization.
Identifiers: *Iron and steel industry, Gross water use.

To help assure adequate management of water supplies of present and future industrial areas, water requirement data from a series of field surveys of iron and steel plants are presented. Principally for cooling purposes, gross water use in integrated steel plants ranged from 11,200 to 110,000 gal/ton of steel ingots, and in steel processing plants from 4,180 to 26,700 gal/ton. Fifteen iron ore mines and 15 ore concentration plants together withdrew annually about 89,000 million gal to produce 15 million tons of iron ore concentrate, or 5,900 gal/ton of concentrate. Surface-water sources accounted for about 97% of the water used; reclaimed sewerage and ground water, the rest. Reuse in the iron ore industry, and treatment of water for use in the iron and steel industry were not widely practiced. The quality of available water was found not to be a critical factor in selecting sites for steel plants. (Llaverias-USGS)
W69-03965

WATER RESOURCES OF THE MARQUETTE IRON RANGE AREA, MICHIGAN,
Geological Survey, Washington, D. C.
S. W. Wiitala, T. G. Newport, and E. L. Skinner.
Geol Surv Water-Supply Pap 1842, 1967. 142 p, 40 fig, 4 plate, 24 tab, 27 ref.

Descriptors: *Water resources development, *Benefication, *Surface groundwater relationships, Michigan, Groundwater, Industries, Natural flow, Geology, Discharge (Water), Recharge, Hydroelectric power.
Identifiers: *Marquette Iron Range area, *Escanaba River.

Water data are summarized on present availability of water, future potential, and other elements relating to the water resources. Benefication and pelletizing processes in the iron and steel industry require large quantities of water, and the best potential sources for immediate development are inland lakes and streams. The natural flow available is about 190 cfs, but the development of storage sites could increase this amount to about 450 cfs. Extensive outwash deposits, the best sources of groundwater, could also be developed. For most uses, the chemical quality of the surface and groundwaters is generally acceptable. Some management problems discussed are time distribution of available water supplies, distribution of water to points of use, effect of surface-water development upon groundwater, and possible conflicts with competing uses. (Llaverias-USGS)
W69-03971

GEOLOGY AND GROUNDWATER RESOURCES OF THE BIG SANDY CREEK VALLEY, LINCOLN, CHEYENNE, AND KIOWA COUNTIES, COLORADO,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03974

WATER RESOURCES OF JACKSON AND INDEPENDENCE COUNTIES, ARKANSAS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03976

MAN AND HIS WATER RESOURCE,
Utah State Univ., Logan.
Dean F. Peterson.
32nd Faculty Honor Lecture, Utah State University, Feb 1966, 43 p, 3 fig, 1 photo, 12 ref.

Descriptors: *Pollution control, *Water resources development, *Research and development, *Institutional arrangements, *Water policy, Consumptive use, Water desalting, Cloud seeding, Water transfer.
Identifiers: Adaptation of environment, National water objectives.

Today, as in earliest civilization, growth is dependent upon overcoming a water-restricted environment and developing the water resource. Water institutions and policy problems are extremely important to our economic and racial future. Except for irrigation, actual consumptive use of water in the United States, is only about three per cent of all withdrawals. The author contends that the central problem in water resource management is therefore quality and not quantity. He further contends that on a national scale regional shortages may be reduced by such action as long-distance transfers, desalting and rainmaking and that the greatest benefits will accrue through improved planning and by pollution control. Adaptation of man's environment rather than dependence upon technological advances is proposed as a more efficacious approach to problem solving. While continuing research is needed in the physical and behavioral sciences, the author proposed that there is an even broader obligation -- the need for the intellectual community to evaluate and criticize the overall problem. Establishing national objectives rather than just trying to provide a sufficient supply of water is seen as needing the highest priority. (Starr-Chicago)
W69-04035

CREEKS, BROOKS AND RIVERS IN ROCKLAND COUNTY, NEW YORK AND THEIR RELATION TO PLANNING FOR THE FUTURE,
Geological Survey, Washington, D. C.
Gordon R. Ayer, and F. H. Pauszek.
New York State Dept. of Commerce, Bulletin No. 6, 1963, 140 p, 36 fig, 2 map, 4 photo, 50 tab, 11 ref, 1 append.

Descriptors: *Water quality, *Water supply, Human population, *Streams, *Rivers, Recreational demand, Usable storage, Pollution abatement, Drainage patterns, Flood control, Sediment load, Water temperature, Alteration of flow, Urbanization, Hardness (Water).
Identifiers: Industrial growth.

The report defines the quality and quantity of water resources available to Rockland County. Water supply is a future problem, since the population is increasing, industries are growing, and the demand for water recreation is widening. The report recommends additional storage of surface water to make a larger part of the streamflow available for use. Present problems include pollution abatement, drainage, and flood control. Drainage basin characteristics and water quality are discussed for each creek, brook, and river in the county. In general, the chemical quality of the surface water is satisfactory for many uses; but, for use as a public water supply, the level of dissolved solids must be reduced. The sediment load, a problem of moderate magnitude, and the temperatures of some streams are determined. Streamflow variability because of precipitation, geography, and man's regulation is described for major streams over a two-year period. Future problems caused by highway construction, urbanization, pollution, and changes in streamflow regimen are discussed. It is impossible to prescribe definite solutions for these problems because of the time scope of the study. (Gossen-Chicago)
W69-04036

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

ALTERNATIVE WATER DEMANDS AND THE ADEQUACY OF PRESENT ARRANGEMENTS,
North Carolina Univ., Chapel Hill. Inst. of Government.
Milson S. Heath, Jr.
Water Resources and Economic Development in the South, Agr. Policy Inst., North Carolina State University, pp 53-65, Aug, 1965. 13 p, 3 ref, 1 append.

Descriptors: Waste disposal, *Riparian rights, *City planning, Irrigation, *Legislation.
Identifiers: North Carolina, *Agricultural economics.

This paper is a progress report of a research project being carried out by the author. The research was done in the fields of agricultural economics, water rights law and regional water and sewer services. The following are the principal units of study of the project which this paper summarized: Industrial water use, municipal water supply, city and regional planning, irrigation, water recreation, water rights law, valuation of water in competing uses, public utility law, and ground water contamination. This paper also includes some conclusions of the author's project. (Grossman-Rutgers)
W69-04058

ESTIMATING DEMAND EQUATIONS,
Louvain Univ. (Belgium).
A. P. Barten.
Econometrica, Vol 36, No 2, pp 213-251, April 1968. 39 p, 10 tab, 18 ref, 2 append.

Descriptors: *Demand, Estimating, Income, Prices, Elasticity of demand.
Identifiers: *Demand equations, Restrictions, Nonlinear, Random shocks, Stochastic component, Interdependence, Systematic factors.

Attempts to estimate demand equations can, roughly, be classified into two groups. To the first group belong those studies which concentrate on an empirically acceptable explanation of demand for individual commodities, while the overall relationships between the quantities demanded of all commodities in the budget remain in the background. The second group of studies is chiefly concerned with the allocation aspect of consumer demand and has complete systems of demand equations as its object. The overall restrictions on demand equations provided by the theory of consumers' choice play a dominant role in these studies. This article belongs to the second group. It considers a complete system of demand equations with coefficients which satisfy the theoretical restrictions in an exact way. The estimation of these coefficients is complicated by the nonlinear nature of the restrictions and the interdependence between the equations. These difficulties are shown not to be insurmountable. This article is relevant for attempts to integrate the water commodity into a complete system of demand equations. (Loeb-Rutgers)
W69-04062

THE LINEAR AGGREGATION COEFFICIENT AS THE DUAL OF THE LINEAR CORRELATION COEFFICIENT,
Carnegie-Mellon Univ., Pittsburgh, Pa.
Yuji Ijiri.
Econometrica, Vol 36, No 2, pp 252-259, April 1968. 8 p, 32 ref.

Descriptors: *Aggregates, Leontief models.
Identifiers: *Linear aggregation coefficient, *Linear correlation coefficient, Aggregation, Degree of perfectness, Variance.

In this paper the linear aggregation coefficient is defined as a measure of the degree of perfectness of a linear aggregation function with respect to a given basic function, and its properties are analyzed in relation to its dual, the linear correlation coefficient. Implicit in estimated water demand functions (e.g. the demand for water recreation) and water industry production functions is the aggregation problem in econometrics and the linear aggregation coefficient suggested by this paper is relevant to empirical water studies where underlying functions are present. (Loeb-Rutgers)
W69-04063

POOLING OF TIME SERIES AND CROSS SECTION DATA,
Columbia Univ., New York.
V. K. Chetty.
Econometrica, Vol 36, No 2, pp 279-290, April 1968. 12 p, 2 fig, 21 ref.

Descriptors: Time series analysis, Regression analysis.
Identifiers: *Pooling, Time series, Cross section data, Bayesian analysis, Standard error, Statistical demand function, Certainty.

Estimates of parameters from cross section data are often introduced into time series regression as known with certainty, which leads to conditional estimates of the time series regression. This paper develops a method of pooling cross section and time series data from the Bayesian point of view, to estimate all the parameters simultaneously. It is shown that the parameters which are common to both the regressions will have on the average sharper posterior distributions. It is also demon-

strated that the traditional method often leads to underestimates of the standard errors of the time series estimates. The method is applied to estimate the statistical demand function for the U S based on cross section and time series data given in J. Tobin's, 'A Statistical Demand Function for Food in the USA.' The pooling technique of cross section and time series data is a relevant approach to estimating water demand functions and accordingly this modification in this technique suggested by this paper has equivalent applications in empirical studies of water demand. (Loeb-Rutgers)
W69-04066

NORMALLY, FACTOR INPUTS ARE NEVER GROSS SUBSTITUTES,
Illinois Univ., Urbana; and Washington Univ., St. Louis, Mo.
Trout Rader.
Jour Pol Econ, Vol 76, No 1, pp 38-43, Jan/Feb, 1968. 6 p, 11 ref.

Descriptors: *Marginal productivity, Returns to scale, Stability, Profit.
Identifiers: *Factor input, *Gross complements, *Gross substitutes, Maximization, General equilibrium, Production function, Concavity.

If increases in one factor increase the marginal productivity of other factors, the demand for factors by competitive firms always displays complementarity between the factors. Increases in one factor price always decrease demands for other factors. On the other factors increases relative to the factor whose price increases. Multivariate functions of the water production process are the relevant theoretical applications of this paper for water resource problems. (Sokoloff-Rutgers)
W69-04073

'INFERIOR FACTORS' AND THE THEORIES OF PRODUCTION AND INPUT DEMAND,
Michigan State Univ., East Lansing, Mich.
C. E. Ferguson.
Economica, New Series, Vol XXXXV, No 138, pp 140-150, May 1968. 1 p.

Descriptors: Prices, Elasticity of demand, Marginal costs, Profits.
Identifiers: *Input demand function, Imperfect competition, Input price, Production function, *Inferior factor, Maximization.

Let p denote commodity price and p (sub i) the parametric market price of the ith input used in producing the commodity. In a previous paper Ferguson proved that in general the sign of the partial derivative of p with respect to p (sub i) is indeterminant, even though a positive relation is normally expected. An inverse relation between commodity and factor prices can exist if, and only if, the input in question is 'inferior.' An input is inferior if an increase in its price leads to an increase in the equilibrium output of the firm. The following propositions are proved in the paper. A factor can be inferior only for a certain range of output; no inferior factors can exist if the Hessian of the production function contains only negative elements on the principal diagonal and negative elements elsewhere; for an inferior input the weighted sum of input demand cross elasticities is positive; the marginal cost of output varies inversely with the price of an inferior input. The concluding section points out the dangers of drawing graphical analogies between the theories of consumer and producer behavior. Industry water production functions which may involve 'inferior' inputs in some stages of production are involved in the arguments stated in this paper. (Sokoloff-Rutgers)
W69-04074

SAVING AND UNCERTAINTY: THE PRECAUTIONARY DEMAND FOR SAVING,
Harvard Univ., Cambridge, Mass; and Stanford Univ., Palo Alto, Calif.
Hayne E. Leland.
Quart Jour Econ, Vol 82, No 3, pp 465-473, August 1968. 9 p.

Descriptors: Risks, Income, Probability.
Identifiers: *Saving, Precautionary demand for saving, Future income, Risk aversion, Utility function, Consumption.

The paper considers a two period model of consumption. Income in the first period is known. A subjective probability distribution for income in the second period is also known. The consumer must determine his consumption for the first period before he knows the actual value of his second period income. The author is interested in the level of saving as future income becomes more uncertain about a given expected value. It is shown that risk aversion alone is insufficient to guarantee a positive precautionary demand for saving. But additional assumptions on certain risk properties of the utility functions, assumptions which would seem to have considerable intuitive and empirical support, are introduced to guarantee the positive effect of uncertainty on saving. A section is devoted to the important implications the theoretical results may have on the theory and estimation of the consumption function. This article has relevance to water demand estimation that is treated in a consumption function framework. (Loeb-Rutgers)
W69-04077

COMPETITIVE EQUILIBRIUM UNDER UNCERTAINTY,
California Univ., Berkeley.
Roy Radner.
Econometrica, Vol 36, No 1, pp 31-58, January 1968. 28 p, 2 tab, 7 ref.

Descriptors: Equilibrium, *Risks.
Identifiers: Nonconvexities, Information, Liquidity, Spot market, Neoclassical theory, Pareto optimum, Competitive equilibrium, Consumer.

This paper explores how far one can go in applying the modern theory of competitive equilibrium to the case of uncertainty. In the first part, the analyses of Arrow and Debreu are extended to the case in which different economic agents may have different information about the environment. The second part deals with the limitations of the Arrow-Debreu type of model, and discusses the difficulties associated with nonconvexities in the production of information, with information generated by spot markets, and with limitations on the computational capacities of economic agents. It is argued that the demand for liquidity arises from the last two phenomena, and thus does not appear to be amenable to analysis of the 'neoclassical' theory of competitive equilibrium. The issues raised in this paper are applicable to water demand and supply models that involve uncertainty of information. (Loeb-Rutgers)
W69-04078

THEORY OF CONSUMER BEHAVIOR WHEN PRICES ENTER THE UTILITY FUNCTION,
Purdue Univ., Lafayette, Ind.; and State Univ., of New York, Stoney Brook.
Peter Jason Kalman.
Econometrica, Vol 36, No 3-4, pp 479-510, July-October 1968. 14 p, 1 fig, 11 ref.

Descriptors: Prices.
Identifiers: Consumer behavior, Utility function, Generalized Slutsky equation, Commodities, Restrictions, Comparative statics.

In this paper, an extension of the theory of consumer behavior to cover situations when prices enter the utility function is considered. In Section 1 and 2 the author formulates the problem and derives a generalized Slutsky equation where the traditional Slutsky equation is a special case. He investigates the class of utility functions that yield homogeneous of degree zero demand functions in prices and income and also states that these do not exist for a certain class of utility functions. He than establishes theorems on 'substitutable' and 'complementary' commodities which are not, in general, valid for the traditional theory. Finally, a set of qualitative restrictions on demand functions is deduced, of which a subset is identical to the traditional restrictions. Water demand analyses involving underlying utility functions that contain price variables can be conceived as a behavior situation treated in this paper. (Loeb-Rutgers)
W69-04079

A NOTE ON THE DIFFERENTIABILITY OF CONSUMER DEMAND FUNCTIONS,
Pennsylvania Univ., Philadelphia.
Donald W. Katzner.
Econometrica, Vol 36, No 2, pp 415-418, April 1968. 4 p, 1 fig, 4 ref.

Descriptors: *Demand.
Identifiers: Differentiability, Consumer demand functions, Utility functions, Necessary condition, Sufficient condition.

An example of a twice, continuously, differentiable utility function whose generated demand functions are not differentiable everywhere is given, along with necessary and sufficient conditions for such differentiability. Utility functions are implicit in water market demand analyses and the particular category of utility functions presented here may have relevance in water studies. (Loeb-Rutgers)
W69-04080

ON PERVERSE CONSUMPTION PATTERNS,
Bruno Trezza.
L'Industria, Vol 102, No 3, pp 357-362, July-Sept 1968. 6 p, 2 fig.

Descriptors: *Growth rates, *Interest rate, *Consumption use.
Identifiers: Real wage, *Steady state, Monotonic, Techniques, Production function, *Reswitching, Marginal propensity to consume.

In their recent paper Bruno, Burmeister and Sheshinki have shown that in a steady state there may exist 'a perverse case in which a low interest rate is not always associated with high consumption' even without reswitching of techniques. They further add that conditions preventing reswitching between any pairs of techniques, which are overly strong to preclude reswitching of techniques on the outer envelope, may be necessary if monotonicity of per capita consumption as a function of the interest rate is to be preserved. In this paper it is shown that the above conjecture is incorrect insofar as it holds only for special values of the steady rate of growth. If the stationary state is abandoned nothing in general can be said about the relation between the rate of interest and per capita consumption even when a monotonic relation is assumed to exist between the rate of interest and the rate of growth. If a Kaldorian saving function is now added to the model the relation between per capita consumption and the rate of interest becomes negatively monotonic. Theoretical water consumption analyses could be involved with certain problems presented in this paper, in particular water production processes related to interest rate phenomena may be relevant. (Sokoloff-Rutgers)
W69-04089

AN INPUT-OUTPUT SYSTEM INVOLVING NON-TRANSFERABLE GOODS,
Osaka Univ. (Japan); and Kobe Univ. (Japan).
Michio Morishima, and Yasuo Murata.
Econometrica, Vol 36, No 1, pp 71-92, January 1968. 22 p, 14 ref.

Descriptors: Durability, Interest rate, Profit, Wages, Depreciation, *Input-output analysis.
Identifiers: *Capital goods, Malleability sectoral, *Flexible acceleration principle, Final demand, *Dynamic nonsubstitution theorem.

This paper distinguishes vintages of capital goods. These goods are assumed to be mobile within each industry, but immobile between industries. The replacement coefficients of the true dynamic input-output model are not generally constant but depend on the age composition of capital. A Sectoral Flexible Acceleration Principle is obtained instead of the simple one, upon which many writers have relied on the explanation of investment demands. The dynamic input-output equations of the traditional form can be validated only when capital goods are 'perfectly malleable.' This is a very stringent and unrealistic condition. When it does not hold, the replacement coefficients cannot be constant and deviate from Leontief's (constant) flow coefficients. If the assumption of perfect mobility were rejected, the dynamic nonsubstitution theorem could not be obtained. Finally it is shown that the equilibrium rate of growth calculated from the traditional model would not be very far from the one calculated from the model used in the paper, so that from the long run viewpoint, there is little difference between the two. Some water studies have used input-model analyses and the problems raised in this paper could have relevancy to the approach to water resource problems. (Sokoloff-Rutgers)
W69-04090

THE CONSTRAINED DEMAND FOR PUBLIC ASSISTANCE,
New York Univ., N. Y.
Peter S. Albin, and Bruno Stein.
Jour Human Resources, Vol III, No 3, pp 300-311, Summer 1968. 12 p, 4 fig, 9 ref.

Descriptors: *Demand, Wages, Income, Administration, Supply, Constraints.
Identifiers: *Public assistance, *Constrained demand, Relief income, Utility analyses, Work.

Public assistance is treated as a transaction with a demand and a supply side. The theory of demand is explored under the hypothetical condition of free choice to individuals between wage income and relief income. Then more realistic situations are examined in which able-bodied individuals are required to seek work if work is available at some social minimum wage rate. The work requirement is treated as one of several existing constraints upon choice. To this are added the various disutilities that, in effect, lower the value of relief income to the recipient and further alter his choice. The analysis suggests that welfare authorities (the supply side) can and do vary the constraints and disutilities so as to change the magnitude of the demand for public assistance. Administrative behavior then becomes a variable in the determination of the number of recipients, that equilibrates demand with supply. No direct analogy to water problems is present while the issue of public assistance can be conceived to involve the redistribution aspects often present in the development of water resources. (Winn-Rutgers)
W69-04093

ON THE MEASURE OF RISK AVERSION,
Harvard Univ., Cambridge, Mass.
M. S. Feldstein.
Southern Econ Jour, Vol 35, No 1, pp 58-59, July 1968. 2 p, 4 ref.

Descriptors: Risks, Measurement.
Identifiers: Risk aversion, Utility analysis.

If an individual's utility of wealth function is strictly concave so that u' (w) greater than 0 and u'' less than 0, he will be averse to risk. Arrow, Pratt and Schlaifer have suggested two ways of representing the intensity of risk aversion at each value of wealth by measures of the local concavity of the utility function. The first measure, which may be called 'absolute risk aversion,' is defined as r sub 1 (w) = -u'' (w)/ u' (w); the second measure, 'proportional risk aversion,' is defined as r sub 2 (w) = -u/u''/u' (w). The first purpose of this note is to provide further support for the assertion that r sub 1 (w) is an appropriate measure of risk aversion and not merely an indicator of utility function curvature. A second purpose is to indicate that r sub 1 (w) may be preferable to r sub 2 (w) as a measure of risk aversion. This article is relevant to water demand functions involving underlying utility functions that can be shown to have the risk properties derived in this paper. (Winn-Rutgers)
W69-04094

A CAPACITY EXPANSION PLANNING MODEL FOR MUNICIPAL WATER SUPPLY SYSTEMS,
Harvard Univ., Cambridge, Mass.
Clifford Springer Russell.
Harvard Water Program, Discuss Pap No 68-10, Sect 11 and 12, pp 251-301, July 1968. 51 p, 3 fig, 8 tab, 83 ref.

Descriptors: *Water supply, *Planning, Municipal water, *Mathematical models, Design, *Economic efficiency, *Growth rates, Water demand, Water shortage, Safe yield, Discount rate, Population, Constraints, Droughts, Water management (Applied).
Identifiers: Massachusetts, Sensitivity analysis.

A mathematical model was developed which determined the optimum (least-present value of costs and losses) expansion scheme for a municipal water supply system. The decision variables were the timing and sizes of system supply increments. It was assumed that information about growth of demand, population, losses due to shortages (information obtained earlier in the main report) were given. For the 60-year study period only four increments were allowed two being in year 0 and year 60. Also, the growth in safe yield was constrained to be equal to the growth in demand for the study period. Results of a parametric analysis on the 'drought-loss function parameter', the 'safe-yield cost scaling factor', discount rate, population and demand growth rates, for model solutions for several Massachusetts towns were tabled and discussed in the following section (Gysi-Cornell)
W69-04145

GROUND WATER AND COMPUTER SIMULATIONS,
TRW Systems Group, Redondo Beach, Calif.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-04149

6E. Water Law and Institutions

FUNCTIONS OF THE INTERNATIONAL JOINT COMMISSION,
International Joint Commission, Washington, D. C.
Eugene W. Weber.
Proc Amer Soc Civ Eng, J Power Div, Vol 94, No PO2, pp 177-181, Nov 1968. 5 p.

Descriptors: *International Joint Commission, Governments, Waterways, Management, Organizations, Planning, Water pollution, *Water resources, Water rights, Water control, River basin development, Water pollution, Control, Boundaries (Property), Treaties, International commissions, Federal Government.
Identifiers: *International relations, Water resources management, Canada.

Canada and the United States have a unique and effective joint organization for managing water resources and dealing with pollution and other matters of mutual concern along their common frontier. By treaty in 1909, the 2 countries established a permanent Commission of 6 members (3 from each country) to exercise certain delegated powers and, upon request, to prepare recommendations for joint action on other matters. The treaty prescribes basic principles applicable to the Commission's responsibilities. One main responsibility of the International Joint Commission is to approve or disapprove proposals for use, obstruction, or diversion of boundary waters and downstream waters that would affect the natural level or flow of waters at the boundary. The Commission functions by calling upon established agencies in each country that are qualified to deal with the problem at hand. The system has worked harmoniously, and is being used increasingly for advance planning for joint actions of mutual benefit and for settlement of current problems. (USBR)
W69-03796

LAW OF THE RIVER,
William Burke.
Fed Reserve Bank San Francisco Mon Rev, pp 193-203, Oct 1968. 11 p, 4 fig.

Descriptors: *Water law, Rivers, *Legal aspects, Riparian rights, *Southwest U. S., Water shortage, *Water resources development, Colorado River Basin, Colorado River Compact, Arid lands, California, Arizona, *History, *Reviews, Water utilization, Colorado River, Demineralization, Pacific Northwest U. S., Water management (Applied).
Identifiers: Water plans, Pacific Southwest Water Plan, Colorado River Storage Proj., Central Arizona Project, California Water Plan.

A half-century's wrangling over the law of the river is proof that the supply of Colorado River water is severely limited in relation to other resources of the southwest. The imbalance is traceable to a national population that is ever growing and ever shifting southwestward, and to the increasing water needs of families, farms, and factories. On the supply side, water planners are concerned because the river's flow has fallen far short of the amount apportioned by the negotiators of the Colorado River Compact in 1922. The negotiators of that compact assumed (on the basis of average flows since 1896) that 16.8 million acre-ft would be available for apportionment between the Upper and Lower Basin states and exportation to Mexico. The average flow during the 1922-67 period measured only 13.7 million acre-ft; the flow over the last decade has averaged only 12.1 million acre-ft. To obtain their 21st-century water supplies, the teeming millions of the Pacific Southwest may have to seed clouds, reclaim waste water, pump water out of the Pacific, or transport water across distant mountain ranges. A general history is given of legal struggles during this century for water in the southwest. (USBR)
W69-03801

WATER FRONT HARBOR FACILITIES.

N J Stat Ann secs 12:5-1 to 12:5-11 (1968).

Descriptors: *New Jersey, *Harbors, *Permits, *Administrative agencies, Legislation, Navigation, Transportation, Riparian land, Regulation, State government, Cities, Docks, Bridge construction, Planning, Marina, Harbors.
Identifiers: *Water-front facilities, *Harbor facilities.

The Board of Commerce and Navigation's power and duties in relation to water-front and harbor facilities include: (1) investigation of harbor facilities and reporting the condition to the legislature, recommending measures for improvement of navigation and commerce; (2) prevention, by appropriate court action, of encroachment upon navigable waters or riparian lands of the state, compelling the removal of any detrimental structure; (3) approval of any plan for development, by any person or municipality, of navigable water-front property; (4) consideration of and action upon any plans for water-front development when the water-front is a local governing body, such action being the filing of objections and representing the state's interests at a public hearing; (5) upon the request of any political subdivision of the state, preparation of a plan for the improvement and development of the water-front of such subdivision. Also, any improvement made to the water front on navigable

waters without board approval is deemed a purpresture and subject to abatement by appropriate means. (Helwig-Fla)
W69-03810

UNITED STATES V 811.92 ACRES OF LAND,

404 F 2d 303-309 (6th Cir 1968).

Descriptors: *Kentucky, *Condemnation, *Condemnation value, *Property values, Water law, Recreation, Flood control, Reservoir construction, Planning, Judicial decisions, Real property, Legal aspects.

Land was condemned to build a reservoir as part of a flood control project. Later, additional land was condemned for construction of a recreational area. The owner of the land taken for the recreational area sued for additional compensation, claiming the land had enhanced value due to the flood control project. The court held that if the recreational area was within the original contemplation of the flood control project, that the landowner would not be entitled to any enhanced value derived from the project. (Hoffman-Fla)
W69-03811

MCFARLAND V DEKALK COUNTY (DAMAGES ATTRIBUTABLE TO SURFACE WATER NUISANCE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03812

FLOOD PROTECTION.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03813

LEASES OF STATE OWNED UNDER WATER LANDS FOR SHELLFISH CULTIVATION.
N Y Conserv Law sec 302 (McKinney 1968).

Descriptors: *New York, *Shellfish, *Aquaculture, *Leases, Legislation, Legal aspects, High water mark, Buoys, Rent regulation, Administrative agencies, State governments, Beds, Cultivation, Land management.
Identifiers: *State submerged land.

The department may lease state owned under water lands for the cultivation of shellfish, except those lands within five hundred feet of the high water mark. To lease such lands, one must have been a resident of New York for more than one year. The lease term is ten years, the size of the land plots not less than fifty acres, and the rental not less than one dollar per acre. The leases are renewable and transferable. The lots must be marked with corner buoys, and failure to comply is a misdemeanor. Lessee is required to post bond in an amount covering the total rental for the 10 year period, and failure to pay the annual rental within 90 days results in the forfeiture of the bond to the state and revocation of the lease. (Sisserson-Fla)
W69-03814

INTERNATIONAL JOINT COMMISSION - UNITED STATES AND CANADA,
Department of Interior, Washington, D. C.
Matthew Welsh.
For 8-volume Proceedings see Vol 2, No 9, Field 06B, W69-03305. International Conference On Water for Peace, Vol 5, pp 104-109 (1968). 8 p.

Descriptors: *International Joint Commission, *Treaties, *Administrative agencies, *Foreign waters, Great lakes, International waters, Administrative decisions, Federal government, Water rights.

The Boundary Waters Treaty of 1909 created the International Joint Commission to deal with waters forming boundaries between the United States and Canada, and waters flowing from one country to another. The treaty was passed to settle and prevent disputes, and to establish rules governing boundary waters. These rules are outlined. Commission procedures are discussed, and it is pointed out that the commission rarely divides along national lines on questions. The Commission's judicial, investigative, recommendatory, administrative, and arbitral functions are discussed. In a great number of cases, both governments accept the recommendations of the Commission. The role of the Commission in pollution control is outlined. Questions currently being investigated by the Commission are explained.
W69-03815

PETERS V AUBIN (ACTION TO RESTORE WATERCOURSE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03816

REGULATION OF MINING IN INTERNATIONAL WATER - FOUR POSSIBILITIES FACING THE MINING INDUSTRY TODAY.
Mining Engineering, Vol 20, No 7, pp 149-152, July 1968. 4 p.

Descriptors: *International law, *International waters, *International commissions, *Mining, Continental shelf, Foreign countries, Oceans, Jurisdiction, Mineralogy, Exploitation.
Identifiers: Convention On The Continental Shelf, Territorial waters.

The problem of mining outside the Continental Shelf and territorial waters is discussed. The basic objective is to arise at a viable regime which will encourage the exploitation of the minerals of the sea floor. Four alternatives are presented: (1) The wait and see approach. This basically calls for doing nothing until the issue is forced. This plan is not desirable as the absence of a regime would be a deterrent to exploitation. (2) The National Lake System. This calls for dividing up the bottom of the sea among the coastal states. It is unlikely to succeed due to the large number of lakes that would be created and the mass confusion that would result. (3) The Flag Nation Jurisdiction. This permits the exploiter to operate under the protection of the nation whose flag he flies. This plan is lacking since a large volume of rules would be required to effectively operate it and it favors the developed nations too heavily. (4) The most acceptable plan would create an International Authority. This authority would be set up with jurisdiction over the resources in the sea, and it could grant rights and extract rents and royalties for use of these resources. It is, of course, up to the more powerful nations to accept this regime for it to be workable. (Shevin-Fla)
W69-03817

CITY OF EAST ORANGE V TOWNSHIP OF LIVINGSTON (ASSESSMENT OF WATERSHED PROPERTY).

102 N J Super 512, 246 A 2d 178-193 (1968).

Descriptors: *New Jersey, *Assessments, *Agricultural watersheds, *Land classification, Local government, Judicial decisions, Rural sociology, Agriculture, Cities, Taxes, Watersheds (Basins), Water supply, Legal aspects.

Plaintiff, a municipal corporation, sought a judgment directing that defendant municipalities assess certain property owned by plaintiff as farmland under the Farmland Assessment Act of 1964. Plaintiff alleged that the lands, which constituted plaintiff's watershed, were actively devoted to agricultural uses. Defendants contended that the property was used principally for the purpose and protection of a public water supply; therefore, they asserted, the property was not entitled to be taxed especially under the act, and was not entitled to exemptions for recreational or educational uses. The court held that the land was not 'actively devoted' to 'agricultural use' within the meaning of the act, and should therefore be taxed as land used for providing and protecting a public water supply. The facts that the plaintiff had the land available to use as pasture, had requested assistance in starting possible training programs in soil conservation, and had received income through sales of hay, timber, and cordwood from the property were not sufficient to classify the property in issue as farmland within the meaning of the act. (Scott-Fla)
W69-03818

LUNTER V LAUDEMAN (PIER CONSTRUCTION PERMIT).
246 A 2d 540-548 (Md Ct App 1968).

Descriptors: *Maryland, *Local governments, *Piers, *Port authorities, Adjudication procedure, Administrative decisions, Community development, Judicial decisions, Harbors, Cities, Public health, Zoning, Water resources development, Boats, Boating, Water pollution, Administrative agencies, Legal aspects.

Defendant filed an application with the city port wardens to erect a pier with mooring piles, for noncommercial purposes only. This application was granted with certain modifications. Plaintiffs, neighbors of the defendant, appealed this decision to the major and local aldermen. Defendant appealed an order by the major and the aldermen directing him to reduce the length of the pier and the number of boat slips permitted. The court, in examining the city charter, found that the mayor and the aldermen were limited in their review of action of the city port wardens to ascertaining whether the port wardens acted within the scope of their powers and properly discharged their legal duties as provided in the city charter. Therefore, the action of the mayor and aldermen in modifying the order of the port wardens was void. The court further found that the provisions of the city charter were not intended to permit the port wardens to exercise any other police powers of the city. Therefore, objections to the port warden's granting of defendant's application on grounds of zoning violations or possible health and pollution problems should be handled by the city Zoning Board of Appeals or the City Health Officer. (Scott-Fla)
W69-03819

REYNOLDS V REFUGE PLANNING CO (LAND BOUNDARIES).
97 So 2d 101-104 (Miss 1957).

Descriptors: *Mississippi, *Boundaries (Property), *Levees, Judicial decisions, Legal aspects, Maintenance, Eminent domain, Right of way, Easements, Real property.

Under a constitutional provision and an act of the legislature, a right of way for a levee system was taken by eminent domain through an existing plantation. Some years later, the lands of the plantation were sold to two different corporations, the dividing line being the levee. Twelve years later the original grantor executed quitclaim deeds to plaintiff, appellant covering the lands taken by eminent domain. Plaintiff brought this action to cancel adjacent landowner's contract for maintenance of the levee by allowing his cattle to graze thereon, and to recover the reasonable value for grazing of cattle on the levee. The court held that the reversionary rights of the adjacent landowners ran to the center of of the levee, and that plaintiff's quitclaim deeds were worthless. '...where the monument is a stream, street or highway, the conveyance extends to and passes the title to the center thereof.' (Sisserson-Fla)
W69-03821

PEOPLE V METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO (CONSTITU-

TIONALITY OF SANITARY AUTHORITY ACT).
11 Ill 2d 476, 143 NE 2d 550-555 (1957).

Descriptors: *Illinois, *Sewage districts, *Legislation, *Legal aspects, Civil law, Judicial decisions, Local governments, State governments, Governments, Sewerage, Drainage systems, Financing, Public health, Environmental sanitation, Cities.
Identifiers: Due process rights.

Plaintiffs filed suit against the defendant sanitary district, challenging the constitutionality of amendatory legislation that empowered sanitary districts to construct a sewerage or drainage system, to extend or improve an existing system, to serve an area within its corporate limits and to pay the cost of these things by issuing and selling revenue bonds payable solely from the revenue derived from the operation of such systems. The court held that the act does not deny the due process guarantees of the state and federal constitutions. Even though the statute provides for notice by publication of a hearing, the corporate authorities are under no obligation to follow the wishes of persons appearing at the hearing. Provisions that charges against a user of the system may become a lien against the property of the user do not violate due process guarantees either. The court concluded that the act was constitutional, and that the fact that incorporated villages within the district have no power to delegate their authority over public health and sanitation to the district would not result in an unconstitutional usurping of municipal powers. (Scott-Fla)
W69-03822

MILLER V DARBY (DIVERSION OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03823

WIESE V MIEHER (ALTERATION OF DRAINAGE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03824

KEISER V MANN (DIVERSION OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03825

MARCHETTI V LUMAGHI COAL COMPANY (SURFACE SUBSIDENCE FROM UNDERGROUND MINESHAFTS).

13 Ill App 2d 526, 142 NE 2d 815-817 (1957).

Descriptors: *Illinois, *Coal mines, *Land subsidence, Judicial decisions, Mining, Mine water, Underground, Underground structures, Safety, Tunnels, Mineral industry, Subsidence, Settlement (Structural), Legal aspects.
Identifiers: Subjacent support, Mineral rights.

Plaintiff sued defendant for damages to his improved real estate that were allegedly caused by defendant mining company's failure to leave sufficient support under plaintiff's land, and by introducing large quantities of water into the mineshaft, thereby further weakening the support under the property. The court found that the owner of surface land subject to mineral rights granted has the right to subjacent support, and evidence of removal of such support without other proof is prima facie evidence that the removal caused the resulting surface subsidence. The burden of proof then shifts to the mine owner to show the contrary, if he can, by proof of underground conditions. Evidence was introduced that tended to show that defendant had pumped large quantities of water into the mining shaft less than a thousand feet from plaintiff's premises. The court held that there was sufficient evidence to justify submission of the case to a jury, who found in favor of the plaintiff. (Scott-Fla)
W69-03826

UNUSED WELLS, CISTERNS, ETC, TO BE COVERED OR FILLED - POISONING SPRINGS, WELLS, ETC.

Ala Code Tit 14, secs 384, 385 (1958).

Descriptors: *Alabama, *Poison, *Well regulations, Legislation, Legal aspects, Springs, Reservoirs, Water law, Cisterns, Shafts (Excavations).
Identifiers: Fines, Imprisonment.

Any person with an unused well, cistern, or mining shaft on their property is required to either fill or cover such well, etc. Failure to comply with this section will result in a fine of not less than $10 nor more than $50. Any person who willfully poisons a spring, fountain, well or reservoir of water shall, on conviction, be imprisoned in the penitentiary for 10 to 20 years. (Sisserson-Fla)
W69-03827

PROJECTS RELATING TO THE USE OF ATMOSPHERIC WATER RESOURCES.

N Y Gen Mun sec 119 P (McKinney 1965).

Descriptors: *New York, *Local governments, *Water resources development, *Metoric water, Legislation, State governments, Cities, Water resources, Planning, Projects, Taxes, Real property, Costs, Cost sharing.
Identifiers: Atmospheric water resources.

Any municipal corporation is authorized to engage in activities designed to develop the use of atmospheric water resources and to make scientific evaluations of such activities. A municipality may also contract and expend money for these purposes. Two or more municipalities may join in such projects, and may allocate the share of the cost between them by contract. Money for such projects may be raised through taxes on real property. Municipal corporations may accept and disburse grants of public or private money paid or made available by the state or federal government for any such purpose. (Scott-Fla)
W69-03828

BUILDINGS AND OTHER THINGS INCLUDED IN DEEDS TO LAND.

NJ Stat Ann sec 46:3-16 (1940).

Descriptors: *Ownership of beds, *Water rights, *Implied benefits, *New Jersey, Land tenure, Legislation, Ground water ownership, Surface water ownership, Property boundaries, Water rights, Water law, Real property.
Identifiers: *Deeding of land, *Watercourses.

Every deed conveying land shall, unless an exception shall be made therein, be construed to include all buildings, improvements, ways, woods, waters, watercourses, rights, privileges, hereditaments and appurtenances; and the reversions and remainders, rents, issues and profits thereof. (Harris-Fla)
W69-03829

VODOPIJA V TENNESSEE GAS TRANSMISSION CO (DAMAGE TO OYSTERS).

152 F Supp 14-17 (E D La 1957).

Descriptors: *Louisiana, *Dredging, *Spoil banks, *Oysters, Judicial decisions, Bays, Pipelines, Legal aspects, State jurisdiction, Leases, Damages.

Plaintiff owned two oyster leases in Sandy Point Bay granted by the state of Louisiana. The state granted defendant a permit to construct a pipeline, which at one point crossed the mouth of Sandy Point Bay. Plaintiff alleged that when defendant dredged a canal for the pipeline, the spoil banks caused thereby covered his oysters and killed them. There were various problems with proof offered by the testimony of witnesses, and it also appeared that one of the leases had not been issued when defendant commenced operations. The court held that defendant had as much right to lay its pipeline across the bay as plaintiff did to plant his oysters. Therefore, to recover, plaintiff must prove that defendant acted negligently and that his damage resulted from such negligence. The court held that plaintiff had not proved these essential elements of his case, and granted judgment for defendant. (Williams-Fla)
W69-03830

WALKER V FELMONT OIL CORP (CLAIMS TO OIL AND GAS RIGHTS UNDER OHIO RIVER).
240 F 2d 912-918 (6th Cir 1957).

Descriptors: *Kentucky, *Ohio River, *Ownership of beds, *Leases, Oil natural gas, Relative rights, Judicial decisions, Federal jurisdiction, Navigable waters, Riparian land, Riparian waters, Legislation, Administrative agencies, Legal aspects.

Plaintiff and defendants claimed oil and gas rights in the bed of the Ohio River between the thread of the stream and the low-water mark on the northern shore opposite the Kentucky shore. Plaintiffs claimed under land patents from the Commonwealth of Kentucky. Defendants claimed under leases from the County and the State Property and Buildings Commission. Plaintiffs filed action for declaratory judgment to adjudicate the conflicting claims. The district court entered judgment adverse to plaintiffs. The Court of Appeals did not discuss the merits, but remanded back for determination of federal jurisdictional questions, including diversity of citizenship. The court, however, did state that title to the Southern half of the Ohio River, from thread of stream to the Kentucky shore, is in riparian landowners in Kentucky, and title to northern half of river bed, from thread of stream to low water mark on northern shore, is in the Commonwealth of Kentucky. (Wheeler-Fla)
W69-03831

GOODMAN V ELLISH (IMPLIED EASEMENT ON PRIVATE LAKE).
170 NYS 2d 465-468 (S Ct 1958).

Descriptors: *New York, *Easement, *Lakes, Riparian rights, Fishing, Boating, Judicial decisions, Swimming, Legal aspects.
Identifiers: *Private lake.

Plaintiffs bought lakefront lots from defendant corporation, which had developed the property and enlarged the lake. Defendant advertised the lake as a private lake for fishing, boating, and swimming for use of residents only. For several years unrestricted use was made of the lake by purchasers of the lakefront property. Then defendant began collecting a fee in varying amounts from the users of the lake for maintenance. Plaintiffs brought action to enjoin the collection of the fee and opening the lake to the public. The court held that oral representations, advertising and conveyances with reference to a map, all which represented the lake was for the private use of the property owners, created an implied easement to use the lake for boating, fishing, and swimming by the property owners only. Defendant corporation was enjoined from collecting the fee and from opening the lake to the general public. The property owners' right to use lake, however, was dependant on compliance with health laws by some responsible person or corporation for them. (Heckerling-Fla)
W69-03832

SOMERS V HILL (DIVERTING OF WATER ONTO ADJOINING LAND).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03833

YENCHKO V GRONTKOWSKI (ACTION FOR DAMAGE DUE TO INTERFERENCE WITH NATURAL FLOW OF SURFACE WATERS).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03834

PASHLEY V UNITED STATES (FLOOD DAMAGE THROUGH ERECTION OF DAM).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03835

STREAM CONTROL COMMISSION - VIOLATIONS AND PENALTIES.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03836

DRAINAGE OF NOXIOUS OR POISONOUS SUBSTANCES INTO NATURAL WATERWAYS OR CANALS.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03837

DRAINAGE.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03839

BEACH COMMISSION.

NJSA secs 40-55A-1 to 40:55A-12 (1967).

Descriptors: *New Jersey, *Beaches, *Financing, Legisislation, Budgeting, Water law, Legal aspects, Contracts, Cities, Recreation, Recreation facilities, Management, Taxes, Profit, Administrative agencies, Local governments.
Identifiers: *Beach commission.

The beach commission has the general power to manage and control the construction, maintenance, and use of the beach and all property contiguous to the beach, formerly owned and controlled by the municipality. The commission has full power to perform all contracts, agreements, or obligations made theretofore by the municipality dealing with subject matters within the scope of the beach commission's powers. The unexpended balance of the monies formerly controlled by the municipality for beach purposes is to be turned over to the beach commission to be appropriated as the commission shall determine. The comptroller is to credit the beach commission with all funds appropriated to the beach by tax levies. The commission is to submit an annual budget to the board having charge of finances of the municipality. The budget shall include all expenditures and revenues of the beach commission. It is the intent of this statute to make the beach commission self-sustaining. (Holt-Fla)
W69-03840

GENERAL AND REGULATORY POWERS (POWER OF CITIES TO REGULATE SWIMMING).

NJSA sec 40:48-1.9 (1967).

Descriptors: *Legislation, *Swimming, *New Jersey, Ordinances, Legal aspects, Water law, Governments, Cities.

The statute gave the governing body of every municipality the power to regulate and prohibit swimming or bathing in the waters of, in, or bounding the municipality. (Holt-Fla)
W69-03841

WATER FRONT IMPROVEMENTS.
NJSA secs 40:68-1 to 40:68-4, 40:68-7, 40:68-8, 40:68-12 to 40:68-16 (1967).

Descriptors: *New Jersey, *Regulation, *Local governments, *Permits, Cities, Legal aspects, Water law, Piers, Docks, Appropriation, Legislation, Federal government, Leases, Bulkheads, Taxes, Financing, Construction.
Identifiers: *Water front improvements.

Power is given to the governing body of the municipality to acquire and improve water front property within its boundaries. Detailed plans and advertising the letting of contracts are prerequisites for improvements or constructions on acquired property. The governing body may lease improved property for not more than ten years. Ordinances may be passed by the governing body to regulate acquired water front property, and regulation within the municipality is to be done through licenses and permits. Maximum rates for public wharfage, dockage, and cranage may be set by the governing body. All income received by the municipality from water front property within its boundaries is to be allocated for the upkeep of water front property owned by the municipality. The governing body is to provide funds for supervising wharves, docks, and ferries. Before construction or improvement of wharves may begin a license must be obtained the governing body. Construction without a license is deemed a nuisance and one causing such a nuisance is subjected to a criminal penalty. Docks must be dept free from obstructions. The municipality may contribute funds to the federal government for work it performs to preserve water front property and inland channels. (Holt-Fla)
W69-03842

FISH HATCHERIES: POLLUTION OF WATERS USED BY FISH HATCHERIES.
For primary bibliographic entry see Field 05C.
For abstract, see .
W69-03843

PUBLIC WORKS AND IMPROVEMENTS.

NJ Stat Ann secs 40:102-1 to 40:102-9 (1967).

Descriptors: *Legislation, *New Jersey, *City planning, *Community development, Utilities, Municipal wastes, Urban areas, Administration, Seashores, Reservoir construction, Cisterns, Local government, Public benefits, Legal aspects, Financing, Costs, Planning, Assessments, Taxes, Tax rate.
Identifiers: *Seaside associations.

These sections pertain to public works and improvements of seaside associations. Section 1 allows corporate authorities of an incorporated seaside association to open, lay out, or improve streets or sidewalks and to construct cisterns for holding water for public benefit. Section 2 provides that the cost of improving sidewalks or streets shall be assessed upon the lands benefited by them. Section 3 provides that the assessment procedure shall be to draw up a map showing the amount assessed. Thirty days notice shall be given of any meeting to hear objections to the assessments. Section 4 makes the assessment a lien on the land and collectable in such manner as the board may determine. Section 5 allows the corporate authorities of any incorporated seaside association to provide necessary works to supply the inhabitants and premises with artificial light; to keep in repair the streets; to remove garbage; and to appoint peace officers. Section 6 provides that the corporate authorities shall appoint from their number a competent person to keep accounts of all expenditures in making improvements. Such books shall be open to inspection of real estate owners within the seaside association. Section 7 allows the costs of improvements to be assessed upon the owners of real estate benefited, but the cost shall not exceed the sum of five dollars per annum per lot. Section 8 provides that when the improvement is completed, a certificate showing the amount assessed shall be filed with the treasurer and kept within the corporate limits. Section 9 makes all assessments made under this chapter liens on the real estate assessed. (Heckerling-Fla)
W69-03844

FISH AND GAME: NON-RESIDENT FISHING.

N J Stat Ann sec 23: 9-1 (Supp 1968), N J S A sec 23: 9-2 (1940).

Descriptors: *New Jersey, *Legislation, *Angling, *Permits, Tidal waters, Fresh water, Saline waters, Atlantic Ocean, Inland rivers, Inland waters, Delaware River, Regulation.
Identifiers: Delaware bay, Non-resident license, Fishing licenses.

This statute deals with non-resident fishermen. It provides that no non-resident above the age of 14 shall fish in the Delaware River or any inland tidal water, unless he first acquires a non-resident fishing license. The prohibition does not apply to fishing in the Delaware Bay or any of the bays or waters of the Atlantic Ocean or tidal rivers emptying into the Atlantic Ocean. Any violators of this provision shall be liable to a penalty of $20 for each offense. (Stewart-Fla)
W69-03845

FISH AND GAME: DELAWARE RIVER AND BAY AREAS BETWEEN NEW JERSEY AND DELAWARE.

N J Stat Ann secs 23: 9-39, 23: 9-42, 23: 9-46, 23: 9-50 to 23: 9-55 (1940), N J S A secs 23: 9-40, 23: 9-41, 23: 9-44 (Supp 1968).

Descriptors: *New Jersey, *Legislation, *Angling, *Fish, Commercial fishing, Fish management, Fishing equipment, Fishkill, Seines, Nets, Sport fish, Water pollution effects, Pan fish, Fish control agents, Bait fish, Delaware River, Legal aspects.
Identifiers: Delaware bay.

The provisions of this article apply to the waters of the Delaware River and bay lying between New Jersey and Delaware. The first section specifies what devices may be used to catch bait fish. The next section prohibits the use of net fishing at certain prescribed times of the week. The third provision describes the size limitations that must be met before a fish may be kept. The Statute further provides that no person shall willfully break, damage, or destroy a net or seine. The fifth provision deals with the prescription against placing any explosive or poisonous substances in the water to catch or kill fish. The next provision prohibits the sale of food fish except during open season and six days thereafter. The Statute also makes it unlawful for a person to attempt to deter or prevent a warden from enforcing the law. The eighth section prohibits a non-resident from fishing with any device except a rod and reel or handline. The new statutory supplement defines game, bait, and food fish. It goes on to provide that a person may use only a rod and reel or handline to catch game fish. Finally, the Statue describes the devices and defines the seasons that apply to food fish. (Stewart-Fla)
W69-03846

FISH AND GAME: OYSTER FISHING.

N J Stat Ann secs 23: 9-56 to 23: 9-58 (1940).

Descriptors: *Legislation, *New Jersey, *Commercial shellfish, *Dredging, Bays, Inlets, Gill nets, Legal aspects.
Identifiers: Penalties, Misdemeanor.

This article deals with the prohibition against dropping anchor on specified flats while dredging for oysters between sunset or sunrise of any day prior to May 25th of each year. The statute also provides that a person who throws a dredge or other appliance from a vessel into a fill net shall be guilty of a misdemeanor. (Stewart-Fla)
W69-03847

OIL FACTORIES IN RARITAN AND SANDY HOOK BAYS.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03848

SHREWSBURY AND NAVESINK RIVERS.

N J Stat Ann secs 23:9-112.1, 23:9-112.2 (Supp 1968).

Descriptors: *Legislation, *New Jersey, *Ice fishing, Rivers, Fishing, State jurisdiction, Legal aspects.
Identifiers: Misdemeanor, Navesink River, Shrewsbury River, Penalties (Criminal).

These sections deal with ice fishing on the Shrewsbury and Navesink Rivers. The statutes provide that lawful holes made by persons fishing on this river shall not make an opening in the ice larger than 10 inches in diameter or within 15 feet of any other hole in the ice. Any person violating the provisions of this act shall be guilty of a misdemeanor. (Heckerling-Fla)
W69-03849

HUDSON RIVER BETWEEN NEW JERSEY AND NEW YORK.

N J Stat Ann secs 23:9-120 (1940).

Descriptors: *Legislation, *New Jersey, *Hudson River, *New York, State governments, State jurisdiction, Interstate rivers, Interstate compacts, Rivers, Water law, Legal aspects, Fishing.

This section deals with the arrest and punishment of violations on the Hudson River between New Jersey and New York. It provides that if and when the State of New York shall enact a similar law for the arrest and punishment of violations of the game or fish laws of this or the State of New York, committed or attempted to be committed by any person or person fishing in that portion of the Hudson River lying between such States, any game protector, fish warden or other person of either state , who is authorized to make arrests for violations of the game and fish laws of such States, shall have power and authority to make arrests on any part of such river between such States or the shores thereof and to take the person or persons so prosecute such person or persons according to the laws of such state. (Heckerling-Fla)
W69-03850

HUDSON RIVER, NEW YORK HARBOR AND SANDY HOOK BAY (NEW).
N J Stat Ann secs 23:9-122--23:9-125 (Supp 1968).

Descriptors: *Legislation, *New Jersey, *Fishing, *New York, Fish management, Fish conservation, Fish, Hudson River, Bays, Legal aspects.
Identifiers: *Sturgeon, Penalties.

These sections pertain to the taking of sturgeon in the Hudson River, New York harbor and Sandy Hook bay. Section 122 provides that sturgeon taken from this water must be at least 22 inches if the short-nosed variety and 42 inches if a sea sturgeon. Any sturgeon less than these lengths must be returned immediately to the water. Section 123 prohibits possession or sale of sturgeon less than the length herein prescribed. Section 124 provides the term sturgeon shall include fish commonly known as pelican and pinkster. Section 125 specifies the fine for violation of the provisions of this act to be up to ten dollars for each and every fish so caught and had in possession. (Heckerling-Fla)
W69-03851

WATER FRONT IMPROVEMENTS.

N J Stat Ann secs 40:179-122--40:179-125 (1967).

Descriptors: *New Jersey, *Beaches, *Recreation facilities, *Financing, Legislation, Cities, Recreation, Swimming, Parks, Leases, Construction costs, Costs, Atlantic Ocean.
Identifiers: Boardwalks, Pavilions, Streets.

It is lawful for any city on or near the Atlantic Ocean to build, maintain and improve public boardwalks, streets, drives, parks or pavilions for the use of the public and to acquire property for these purposes. Such city shall have the power to issue bonds to raise money for beach improvements, provided that the creation of any indebtedness beyond the limit fixed in its charter shall be submitted to a referendum election. The pavilions built under authority of this act shall not be leased to any person. (Helwig-Fla)
W69-03852

EXCHANGE OF RIPARIAN LANDS.

N J Stat Ann sec 40:176-9 (1967).

Descriptors: *New Jersey, *Legislation, *Riparian lands, *Cities, City planning, Eminent domain, Administrative agencies, Local governments, Public benefits.

Any city of the first class owning any riparian lands which have ceased to be suitable or convenient for the use for which they were acquired may exchange the lands for other riparian lands in the same city which are more suitable or convenient for public use, conveying all rights to the land and any structures upon it. The Board of Commerce and Navigation must approve of any exchanges made under this act. (Helwig-Fla)
W69-03853

LEASE OF OCEAN FRONT PROPERTY.
N J Stat Ann sec 40:176-20 (1967).

Descriptors: *New Jersey, *Oceans, *Shores, *Leases, Legislation, Recreation, Recreation facilities, Cities, Coasts, Contracts, Beaches, Local governments.

This statute authorizes cities having a population of less than 25,000 to lease property or buildings bordering on the ocean without public bidding in the following cases: (1) leases to charitable or religious organization for less than 1 year; (2) leases not exceeding 2 weeks where the premises are to be used for amusement purposes. Leases shall be in writing and authorized by a resolution of the governing body of the city. Notice of intent to adopt a resolution shall be given prior to adoption of a resolution if the lease is to be for premises used for amusement purposes. (Helwig-Fla)
W69-03854

PROTECTION OF WATER SUPPLY FROM POLLUTION.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03855

PUBLIC UTILITIES - LIGHT AND WATER SUPPLY.
For primary bibliographic entry see Field 03D.
For abstract, see .
W69-03856

STREETS AND PUBLIC PLACES - STREETS ALONG STREAMS.
N J Stat Ann secs 40:178-3--40:178-7 (1967).

Descriptors: *New Jersey, *Legislation, *Road construction, Roads, Highways, Civil engineering, Transportation, Road design, Planning, Condemnation, Easements, Cities, Local governments, Construction.
Identifiers: Ordinances.

This statute gives the body having control of streets and highways in any city the power, by ordinance, to open roadways over and along non-navigable natural streams, to alter the course of such streams to provide a more direct route for the roadway, and to acquire lands for such purposes. This power includes the power to provide construction to carry the flow of the streams and support the roadway. Before enacting any ordinance under this act, the controlling body must publish notice, including plans and costs of the proposed changes. If any public improvement contemplates the taking of lands owned by a non-resident, personal notice by mail must be given. The controlling body shall have the power of condemnation. (Helwig-Fla)
W69-03857

SEWERS, DRAINS - CHANGE OF COURSE OR OUTLET.
For primary bibliographic entry see Field 05F.
For abstract, see .
W69-03858

SURFACE DRAINAGE.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03859

LINES ALONG HIGHWAY AND ACROSS WATERS.

Me Rev Stat Ann tit 35, sec 2341 (1965).

Descriptors: *Maine, *Legislation, *Transmission lines, Transmission (Electrical), Public benefit, *Bodies of water.

Section 2341 of title 35 pertains to transmission lines along highways and across waters. It provides that every corporation organized under chapters 171 to 179 for the purpose of operating telegraphs or telephones or for the purpose of transmitting television signals by wire may, except as limited, construct, maintain or operate its lines upon and along the route or routes between the points stated in its certificate of incorporations; and may, subject to the conditions and under the restrictions provided in chapers 171 to 179, construct its lines along, over, under and across any of the roads and streets and across or under any of the waters upon and along such routes, with all necessary erections and fixtures therefor. (Heckerling-Fla)
W69-03860

LEASES OR DEEDS OF RAILROAD OR CANAL PROPERTY IN MORE THAN ONE COUNTY.
N J Stat Ann sec 46: 16-3 (1940).

Descriptors: *Legislation, *New Jersey, *Canals, State government, Leases, Legal aspects.
Identifiers: Deeds, Railroads.

Section 3, Chapter 16, Title 46, provides that leases or deeds of conveyance of any railroad or canal located and constructed in more than one county of this state, made or to be made, shall and may, when acknowledged or proved and certified as pro-

vided by this title, be recorded in the office of the secretary of state, in a book by him to be provided for that purpose. (Heckerling-Fla)
W69-03861

OPERATING RESTRICTIONS ON WATERCRAFT.

Me Rev Stat Ann Tit 38, secs 281-285 (1965).

Descriptors: *Legislation, *Maine, *Boating, Boats, Recreation, Water sports, Tidewater, Municipalities, State jurisdiction, Bodies of water, Atlantic Ocean, Bays.
Identifiers: Crimes, Fines, Penalties.

Sections 281 through 285, Title 38, pertain to operating restrictions on watercraft, Section 281 makes it illegal to operate any watercraft, vessel, water skiis, surfboard, similar device or motorboat, upon the tidewaters of any municipality or on offshore waters at a speed greater than is reasonable and proper. Violations of this section are punishable by a fine of not less than $10 nor more than $100, or by imprisonment for not more than 90 days. Section 282 makes endangering any person or property by a watercraft punishable by a fine of not less than $10 nor more than $100, or by imprisonment for not more than 90 days, or by both. Section 283 makes operation of a watercraft in a wanton manner so as to cause injury to any person or property punishable by a fine of not less than $50 nor more than $200, or by imprisonment for not more than 3 months, or by both. A second conviction carries a fine of not less than $200 nor more than $500, or by imprisonment for not more than 11 months, or both. Section 284 makes operation of a watercraft while intoxicated or under the influence of any narcotic drug, barbituate or marijuana, punishable by a fine of not less than $10 nor more than $100 and/or imprisonment for not more than 90 days. Section 285 empowers every law enforcement officer in the state to enforce this subchapter. Any officer may hail a watercraft and board it in order to enforce said subchapter, and failure to stop shall be punished as provided in Section 282. (Heckerling-Fla)
W69-03862

CORRUPTING WATERS FORBIDDEN.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-03863

BRIDGES OVER CANALS OR RAILROADS.

Me Rev Stat Ann tit 35, sec 815 (1965).

Descriptors: *Legislation, *Maine, *Bridges, Engineering structures, Bridge construction, Railroads, Canals, Transportation, Civil engineering, Roads, Legal aspects, Cities, Operation and maintenance, Repairing.

This section provides that a railroad may be constructed over or under a canal or railroad in such manner as to not unnecessarily impede the travel or transportation thereon. The municipal officers of any city or town may give notice in writing to such persons, parties, or corporations that a bridge required at a crossing has not been erected, or is out of repair and not safe and convenient, or that the crossing of any such highway or town passing such railroad at grade, within their respective cities or towns, is not made or maintained in a safe or convenient condition as is required by the act. Such persons, parties, or corporations shall erect or repair such bridge or shall make such crossing safe and convenient within 10 days from the service of said notice; otherwise, a court may order such delinquents to erect or repair such bridge or make such crossing conform to the requirements of the act. (Heckerling-Fla)
W69-03864

PUBLIC PARKS ON BEACH OR OCEAN FRONT.
N J Stat Ann secs 40:179-98 to 40:179-105 (1967).

Descriptors: *New Jersey, *Beaches, *Recreation facilities, *Public lands, Legislation, Oceans, Shore, Recreation, High water mark, Condemnation, Public benefits, Waves, Riparian lands, Riparian rights, Accretion (Legal aspects), Regulation, Financing, Costs.
Identifiers: Public use.

It is declared lawful for any city located on or near the ocean to open along the ocean front a park or resort devoted to public use exclusively. The interior or inland line of such park shall be established and worked, and a description filed in the office of the City Clerk. This interior line shall be no further inland than ordinary high-water mark. The city where the line is filed shall have the power to purchase or condemn all lands or interests within the interior and exterior lines, the latter established by the state riparian commissioners, and devoted such land to public use. The city shall have the authority to build a public boardwalk along the established interior line. The city may accept a dedication of land for public use in accordance with this act, and shall have the authority to construct any public walk so that the owners dedicating such land may secure the benefit of any natural accretions made to the land. The city shall regulate the use of the land devoted to public use. All lands condemned under this act shall become the property of the city so condemning and the proceedings shall follow the proper condemnation statutes. A benefit assessment shall be made upon all owners benefited by improvements made under the authority of this act. (Helwig-Fla)
W69-03865

SHAD FISHING ON HUDSON RIVER.

N J Stat Ann secs 23:9-14, 23:9-116--23:9-119 (1940); N J Stat Ann secs 23:9-115 (Supp 1968).

Descriptors: *Legislation, *New Jersey, *Fishing, *Hudson River, Fish management, Commercial fishing, Fish conservation, Nets, Fishing gear, Administrative agencies, State jurisdiction permits, Legal aspects.
Identifiers: *Shad, Crimes, Penalties (Criminal).

These sections pertain to shad fishing on the Hudson River. Section 114 makes it unlawful for any person to fish with, fix, fasten, draw or drift any net, of whatever description, for the purpose of taking shad in the Hudson River within New Jersey without a license to do so. Section 115 provides that after payment of $25.00 to the Board of Fish and Game Commissioners for each net, the Board may issue a license to fish for shad in the Hudson River for the period March 15 to June 15. No shad shall be taken from Friday noon until Saturday midnight. Any net set prior to Friday noon may be lifted at the next high water. Section 116 provides that no net shall be set within 1500 feet of any other licensees net in the above waters. The nets shall be numbered as may be determined by the board. Section 117 makes it unlawful for any person to take fish out of any net without the permission of the owner of the net, and further declares it to be unlawful to willfully cut, break, or mutilate any net set in the above mentioned waters. Section 118 provides that all licenses issued under this article shall expire on December 31 of the year issued. Section 119 makes any person violating this act subject to a fine of $20.00 for each offense. (Heckerling-Fla)
W69-03866

ENTRY ON LAND TO MAKE SURVEYS.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03867

STREAM CONTROL COMMISSION - POWERS AND DUTIES.

La Rev Stat secs 56:1431, 1433-1441 (1965).

Descriptors: *Louisiana, *Administrative agencies, *Regulation, *Water pollution control, Legislation, Legal aspects, Bodies of water, Gulf of Mexico, Investigations, Water quality control, Public health, Water policy, Waste disposal, Streams.

The Stream Control Commission of Louisiana consists of the heads of Wild Life and Fisheries, the Board of Health, Agriculture and Immigration, Commerce and Industry and the Attorney General. 'Waters of the state' are defined as all waters within the confines of the state and all bordering waters, including the Gulf of Mexico. The Commission is charged with control of pollution resulting from waste disposal into any waters of the state. The Commission may make rules and regulations regarding conduct of investigations necessary to carry out the provisions of this part. The Commissioner of Wild Life and Fisheries shall enforce and administer the provisions of this part. The Commission or its agents may enter public or private lands to inspect or investigate conditions relating to the pollution of any waters of the state. The Commission shall establish pollution standards and may prohibit any discharge resulting in pollution. It is illegal to discharge any waste which would tend to destroy fish or wildlife or be injurious to the public health. Persons deemed to be in violation of this part are served notice and must file a full report with the Commission showing what steps are being taken to control the pollution. (Sisserson-Fla)
W69-03868

MASSUCCO V VERMONT COLLEGE CORP (ABANDONMENT OF WATER RIGHTS EASEMENT).
247 A 2d 63-68 (Vt 1968).

Descriptors: Judicial decisions, *Vermont, Legal aspects, *Easements, *Springs, Subsurface waters, Subsurface flow, Water law, *Water rights, Buildings, Reservoirs, Diversion, Watercourses, Geologic investigations.

Plaintiff sought to restrain defendant from blocking his access to spring and reservoir and from diverting the subterranean watercourse which had formerly supplied him with water. Plaintiff acquired a water right easement on defendant's land through a prior conveyance. It was claimed by plaintiff that defendant built a dormitory over the spring that supplied plaintiff with water. Defendant asserted that plaintiff abandoned its water rights. The court found insufficient evidence to support plaintiff's claim. Defendant showed that geological tests prior to construction of the dormitory revealed no spring or subterranean waterway beneath building. However, it found that plaintiff had not abandoned its water rights. In order to extinguish water rights by non-use there must have been adverse conduct by owner of the servient estate in defiance of the easement, and such conduct must be continued for 15 years; or, to produce this effect, the owner of the water rights must show clear intent to abandon them and the servient owner must have relied or acted on this intention so that it would work harm to him if the easement was thereafter asserted. (Holt-Fla)
W69-03894

WATERS IMPOUNDED BY DAMS CONSTRUCTED FOR POWER PURPOSES IMPRESSED WITH PUBLIC INTEREST.
N Y Conserv Law sec 948-a (McKinney 1967).

Descriptors: *New York, *Fishing, *Impounded waters, Civil law, Legislation, State government, Administrative agencies, Water resources, Dams, Reservoirs, Public rights, Conservation, Hydroelectric plants, Legal aspects, Regulation, Warning systems.

The waters impounded by any dam constructed for power purposes on any stream or waterway shall be impressed with a public interest and open to the public for fishing. Such fishing must be in accordance with the rules and regulations of the conservation commissioner, and must not interfere injuriously with the operation and maintenance of the dam or of any manufacturing plant operated by power generated therefrom. The conservation commissioner may exempt from the provisions of this section the waters impounded by any dam constructed for power purposes. The rules and regulations of the commissioner shall be uniform, but may vary in different parts of the state. Warning signs must be posted as provided in this section. (Scott-Fla)
W69-03895

ST. REGIS TRIBE OF MOHAWK INDIANS V STATE (OWNERSHIP OF ISLAND).
4 Misc 2d 110, 158 N Y S 2d 540-551 (1956).

Descriptors: *New York, Judicial decisions, *Appropriation, Condemnation, Eminent domain, Ownership of beds, State governments, Leases, Compensation, Payment, Condemnation value, *Islands, *St. Lawrence River, Treaties.

Plaintiff, an Indian tribe, claimed ownership of an island in the St. Lawrence River which had been appropriated by the State. Plaintiff asked compensation for the taking as prescribed by eminent domain statute. The court pointed out that the right of occupation of lands granted by treaties to the Indian tribes was not a property right; rather, it was merely a right of occupancy which the soverign granted and protects against intrusion by third parties. It is axiomatic, therefore, that this right or privilege may be terminated and such lands fully disposed of by the sovereign itself without any legal obligation to compensate the Indians. On the other hand, where the sovereign has declared that the Indians were to hold certain lands permanently, compensation must be paid for a subsequent taking. The court held that in this case a jury submissible issue of fact existed, and that the case could not be summarily disposed of on a motion to dismiss by the State. (Scott-Fla)
W69-03896

UNITED STATES V SMOOT SAND AND GRAVEL CORP (OWNER OF CONDEMNED RIPARIAN LANDS RIGHTS IN UNDERWATER GRAVEL DEPOSITS).
248 F 2d 822-831 (4th Cir 1957).

Descriptors: *Virginia, *Condemnation, *Riparian rights, *Beds, Legislation, Riparian waters, Riparian land, Legal aspects, Federal government, Gravels, Sands, Eminent domain, Property value, Judicial decisions, Low water mark, Navigable waters, Dredging, Ownership of beds.

Smoot Sand and Gravel Corporation owned riparian land on a bay along the Potomac River. The United States instituted a condemnation proceeding to acquire the tract. The proceeding below involved a controversy concerning the valuation of the property rights of the corporation, and more specifically, whether the landowner had a property right in underwater gravel deposits for which he should be compensated. Virginia law provided that the rights to take underwater gravel may be leased from the State. The statute also provided that riparian owners may obtain a perpetual injunction against anyone removing material beyond the low water mark, and that damages, measured by the value of the material taken, may be recovered from violators. The trial judge interpreted these laws as allowing an exclusive right to riparian owners to dredge underwater sand, and instructed the jury to consider the value of the deposits beyond the low water mark in setting the condemnation award. The appellate court affirmed, ruling that the statutes, taken as a whole, conferred upon riparian owners a property rights, which, in case of infringement, entitled the owners to just compensation. (Wheeler-Fla)
W69-03910

GROVE LABORATORIES V FLOWOOD CORP (WELL WATER RIGHTS CONTRACT INTERPRETATION).
234 F 2d 371-373 (5th Cir 1956).

Descriptors: *Mississippi, *Water contracts, *Water wells, *Water rights, Judicial decisions, Legal aspects, Relative rights, Subsurface waters, Deep wells, Water supply, Wells, Water law, Income, Profit, Monetary benefits.

Plaintiff, defendant, and another party entered into a contract whereby they became joint owners of a well. The contract provided that each party was to own one-third of the well, that each party was to have rights to water without additional cost, and that the parties could agree to sales of water to other persons, with such income to be divided among the parties. Defendant made sales to another party and did not account to plaintiff for any share. Plaintiff brought suit to recover a one-third share of the income from the sales made by defendant. The lower court gave judgment for defendant. The appellate court affirmed, ruling that the right to water of each party under the contract was not limited in any way except possibly to not taking more than its share. (Wheeler-Fla)
W69-03911

SURRENDER OF GRANT.
N Y Pub Lands sec 76 (McKinney Supp 1968).

Descriptors: *New York, *Grants, Legislation, *Beds, Administrative agencies, Legal aspects.

This section provides for the optional surrender, without compensation, of lands under water by one to whom such lands were granted by the state. This section is annotated. (Childs-Fla)
W69-03912

CLAIMS FOR DAMAGE GENERALLY ADJUSTMENT OF CLAIMS OF OWNERS OF PRIVATE DAMS.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03913

GENERAL POWERS AND DUTIES OF COMMISSIONER OF TRANSPORTATION.
N Y Canal Law sec 10.1, 10.3, 10.4, 10.6, 10.7, 10.8, 10.9, 10.11, 10.12, 10.17, 10.22 (McKinney Supp 1968) 3 p.

Descriptors: *New York, *Canals, *Navigation, *Transportation, Legislation, Engineering, Boundaries, Maintenance, Management, Maps, Repairing, Inspection, Regulation, Statistics, Appropriation, Administrative agencies, State governments, Legal aspects.

The commissioner of transportation shall: (1) Have supervision of canal system and enforce administration of canal law; (2) Provide for all engineering services required in the improvement, maintenance, and repair of the canal system; (3) Cause surveys, maps, plans, specifications and estimates to be made for improvement of canal systems; (4) Cause inspections of the system to be made annually; (5) Determine boundaries of the canal system; (6) Keep and maintain the canals and their equipment in good condition; (7) Prescribe regulations for navigation and fines to enforce the rules; (8) Compile statistics relating to the traffic on the canal system; (9) Make an annual report to the legislature regarding the trade on, and the conditions of, the canal system; (10) Cause to be acquired such lands as are needed by the canal system and dispose of land no longer needed; (11) Seize any lands, equipment or supplies necessary to avert damage when an emergency arises endangering life or the canal system. (Shevin-Fla)
W69-03916

DRAINAGE FACILITIES.
N Y Town Law sec 64 (11-a) (McKinney 1968).

Descriptors: *New York, *Drainage systems, *Floods, Legislation, Cities, Drains, Culverts, Ditches, Condemnation, Taxes, Bodies of water, Legal aspects, Local governments, Overflow.
Identifiers: High waters.

The town board of any town may construct drainage facilities or otherwise improve any of the lakes, ponds, streams or water courses in order to prevent overflow from high waters. The town board may acquire real property for such purpose. When taxes are to pay for the expenditures, the adoption of a resolution by the town board authorizing the expenditures is subject to a permissive referendum. (Childs-Fla)
W69-03917

GRANTS OF LANDS UNDERWATER.

N Y Pub Lands Law sec 75 (McKinney 1951) As amended and supplemented N Y Pub Lands Law sec 75 (McKinney Supp 1968).

Descriptors: *New York, *Grants, *Beds, Navigable waters, Hudson River, Navigation, Administrative agencies, United States, Recreation, Conservation, Agriculture, Usufructrary right, Jurisdiction, Lighthouses, Cities, Islands, Legal aspects.
Identifiers: Adjacent landowner, Long Island.

This section authorizes grants of the use, occupation and jurisdiction of land under water. The lands contemplated by this section are the submerged lands of navigable rivers and lakes including the Hudson river, the former bed of the Onondaga creek and Tibbetts brook, the land adjacent to and surrounding Great Barn island but not so as to affect navigation, the land adjacent to and surrounding Staten Island but within 500 feet from the low water mark, and the land adjacent to and surrounding Long Island. Such grants, except in special cases, are to be made only to the owners of adjacent land and may be in perpetuity for agricultural, recreation, conservation or other specified purposes. Various limitations are placed on the grants allowed. Grants may also be made to the United States for the purpose of improving navigation but concurrent jurisdiction by New York and the United States must be maintained over such lands. This section has been amended and is supplemented. (Childs-Fla)
W69-03918

DISPOSITION OF STATE UNDERWATER LANDS.

N Y Pub Lands Law sec 3 (4) (5) (McKinney Supp 1968).

Descriptors: *New York, *Beds, *Permits, Legislation, *Administrative agencies, Administrative regulation, Jurisdiction, Lake Erie, Navigation, Avulsion, Erosion, Sands, Gravels, Regulation, Legal aspects.
Identifiers: Canal lands, Salt spring conservation land.

The commissioner of general services is authorized to transfer to any state department or agency the jurisdiction over any lands, including submerged lands, abandoned canal lands and salt springs reservation land. The commissioner may license and regulate the taking of sand, gravel or other materials found in deposit in or upon the under water lands of the state. The commissioner may authorize the taking of soil from state under water land when taken by an upland owner for the improvement or the protection of his upland from the action of the water or for the restoration of his upland. (Childs-Fla)
W69-03919

ALLOCATIONS, DIVERSIONS, AND RELEASES.

N Y Conserv Law sec 835 Art 3 sec 3.8 (McKinney Supp 1968).

Descriptors: *New York, *Water allocation (Policy), *Diversion, *Discharge (Water), Civil law, Legislation, State governments, Administrative agencies, Conservation, Planning, Water resources, Water conservation, Water supply, Withdrawal, Interstate commissions, Legal aspects, Basins.

The conservation commission shall have the power to allocate the waters of the basin among and to the various member states, to impose upon them related conditions, obligations, and release requirements, and to enter into agreements with other river basin commissions or other states with respect to in-basin or out-of-basin allocations, diversions, and withdrawals. Allocations made under this section shall not be considered prior appropriations or apportionments of the basin waters. This section does not limit or restrict the power of the commission to contract, with respect to water supply, for terms only as long as the creating compact continues in existence. (Scott-Fla)
W69-03920

POWERS AND DUTIES OF THE COMMISSION.
N Y Conserv Law sec 835 art 3 secs 3.1, 3.4 (2) (3) (4) (5) (McKinney Supp 1968).

Descriptors: *New York, *Water allocation (Policy), *Hydrologic data, *Water policy, Civil law, Legislation, State governments, Administrative agencies, Conservation, Planning, Water resources, Water conservation, Water supply, Water resources development, Administration, Legal aspects, Flood protection, Projects, Utilities, Research and development, Basins.

The commission shall develop and implement plans, policies, and projects relating to the water resources of the basin. Policies should be uniform and coordinated to conserve and manage water resources. The planning, development, operation, and financing of water resources projects shall be done under its direction. Such planning should include establishing standards for the above, including utilities, local flood protection works, watershed management programs, and ground recharging operations. It should conduct and sponsor research on water resources and their development, management, and control, and collect, and interpret, and publicize systematic surface and ground water data for use in flood warning, quality maintenance, and formulating and administering the comprehensive plan. (Scott-Fla)
W69-03921

SUSQUEHANNA RIVER BASIN COMPACT - PREAMBLE.
N Y Conserv Law sec 835 (McKinney Supp 1968).

Descriptors: *New York, *Water resources development, *Water policy, *River basin, Civil law, Legislation, State governments, Federal government, Administrative agencies, Conservation, Water resources, Planning, Water supply, Maryland, Administration, Pennsylvania, United States, Public benefits, Commissions, Interstate compacts, Legal aspects.

The Susquehanna River Basin Compact was signed by the member states for the purpose of the conservation, utilization, development, management and control of the basin under the control of comprehensive multiple purpose planning to bring the greatest benefits and produce the most efficient service in the public interest. The planning administered by a basinwide agency should provide flood damage reduction, conservation and development of surface and ground water supply for municipal, agricultural, and industrial uses, development of water recreational facilities, promotion of forest land management, soil conservation, and watershed projects, protection and aid to fisheries, development of hydroelectric power potentialities, control of salt water movement, abatement and control of water pollution, and regulation of streamflows toward attainment of these goals. Members of the compact include New York, Pennsylvania, Maryland, and the United States. The federal government, recognizing a national interest in the basin, has authorized the Army Corps of Engineers, the Department of Agriculture, the Department of Health, Education and Welfare, the Department of the Interior, the Federal Power Commission, the Department of Commerce, and other Federal agencies to cooperate in making comprehensive surveys and reports concerning the water resources of the basin. Concurrent legislation was passed by all members, thus creating the compact. (Scott-Fla)
W69-03922

WATER COMPACTS.
N Y Conserv Law sec 815 Art VI (B) (F) VII (A) (B) (C) (H) (McKinney 1967).

Descriptors: *New York, *Water resources development, *Water policy, *Administration, Civil law, Legislation, State governments, Administrative agencies, Conservation, Water resources, Planning, Water levels, Water pollution, Pollution abatement, Beach erosion, Floods, Navigation, Diversion, Interstate compacts, Legal aspects, Great Lakes Region.

The Commission shall have the power to recommend methods for the development, use, and conservation of the water resources of the basin and to recommend policies relating to water resources, including the institution and alteration of flood plain and other zoning laws and regulations. Each state that is a party to the compact shall consider the action recommended by the commission in respect to stabilization of lake levels, measures for combatting pollution, beach erosion, floods, and shore inundation, uniformity in navigation regulations, and diversion of waters from and into the basin. (Scott-Fla)
W69-03923

GREAT LAKES BASIN COMPACT.
N Y Conserv Law sec 815 art I, II, III, IVA (McKinney 1967).

Descriptors: *New York, *Conservation, *Water resources development, *Great Lakes Region, Civil laws, Legislation, State governments, Administrative agencies, Water resources, Planning, Water policy, Administration, Ohio, Pennsylvania, Illinois, Indiana, Michigan, Minnesota, Wisconsin, Great Lakes, Interstate compacts, St. Lawrence River, Legal aspects.

The purposes of the compact are to promote the orderly development and conservation of the water resources of the Great Lakes Basin, to enable the member states to derive the maximum benefit from utilization of public works, to help secure and maintain a proper balance among the various types of users of the water resources of the basin, and to establish an inter-governmental agency to help accomplish the purposes of the compact more efficiently. Members of the compact include Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin; the Provinces of Ontario and Quebec may join at a later date. The Great Lakes Commission created by the compact shall exercise its powers in respect to the basins, which shall consist of the five Great Lakes, Lake St. Clair, the St. Lawrence River, all water interconnections between them, and all other rivers, lakes, ponds, streams, and all other watercourses which are tributary to the above lakes or comprise part of any watershed draining into said lakes. (Scott-Fla)
W69-03925

CONSERVATION LAW - DEFINITIONS - GENERAL JURISDICTION OF THE COMMISSION.
N Y Conserv Law secs 403 (5) 404 (McKinney 1967).

Descriptors: *New York, *Legislation, *Administrative agencies, *Water resources, Lakes, Bays, Ponds, Reservoirs, Springs, Wells, Rivers, Estuaries, Canals, Atlantic Ocean, Surface water, Public health, Drainage.
Identifiers: N Y State Water Resources Comm.

Sec 403 (5): Waters shall be construed to include lakes, bays, sounds, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marches, inlets, canals, the Atlantic Ocean within territorial limits of the State of New York, and all other bodies of surface or underground water, natural or artificial, inland or coastal, fresh or salt, public or private, which are wholly or partially within or bordering the state or within its jurisdiction. Sec 404: The New York State Water Resources Commission shall exercise its powers and perform its duties in any matter affecting the construction of improvements to, or developments of water resources for the public health, safety or welfare, including but not limited to the supply of potable waters for the various municipalities and inhabitants thereof, the use of water for industrial and agricultural operations, the developed and underdeveloped water power of the state, the facilitation of proper drainage and the regulation of flow and improvement of the rivers of the state. (Shevin-Fla)
W69-03988

NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-03990

DARGAN V RICHARDSON (STATE REGULATION JURISDICTION OVER PRIVATE, MAN-MADE PONDS).

92 S E 2d 167-170 (S C 1956).

Descriptors: *South Carolina, *Ponds, *Permits, *State jurisdiction, Judicial decisions, Legal aspects, Regulation, Fishing, Farm ponds, Fish conservation, Fish management, Riparian rights, Fresh water.

Plaintiff, a private pond owner, obtained an injunction forbidding state and county game wardens from interfering with her customers who were fishing without licenses in her pond. The ponds in question had been excavated by the owner and were entirely segregated from other waters. The ponds were stocked, and persons desiring to fish them were permitted to upon payment of a fee to the plaintiff. The game warden arrested several of the plaintiff's patrons under a statute which forbade fresh water fishing with manufactured tackle without a license. Plaintiff contended that the actions of the defendant game wardens amounted to a taking of her property without the due process of law, and that artificial ponds entirely segregated from other waters were beyond the jurisdiction of the game wardens and the state statutes. This court reversed the trial court and set aside the injunction against the game wardens. After citing numerous statutes which regulated fishing privileges in waters of all descriptions within the state, the court held that while the private right of ownership may rest in the plaintiff, such property right or ownership is not such as to be beyond reasonable regulation by the State. The plaintiff's ponds, though segregated from other waters, still fell within the phrases 'fresh water of this state,' or 'the inland streams or waters of this state' as used in the conservation statutes. The power of the State to impose reasonable regulations (requiring fishing licenses) was not synonymous with and limited to ownership of property. (Blunt-Fla)
W69-03994

RESOURCES RESPONSIBILITY AND COORDINATION RELATED TO THE COMPREHENSIVE STUDY OF THE SUSQUEHANNA RIVER BASIN.
Interstate Advisory Committee on the Susquehanna River Basin.
For primary bibliographic entry see Field 06B.
For abstract, see .
W69-04032

OREGON'S WATER-MANAGEMENT DISTRICTS,
Oregon Univ., Eugene. School of Law.
William L. Hallmark.
Oregon Law Review, December 1967, pp 16-70.

Descriptors: *Oregon, *Water districts, *Interagency cooperation, Irrigation districts, Drainage districts, Boundaries, Eminent domain, State jurisdiction, Federal project policy.
Identifiers: Water control districts, Diking districts, Domestic water supply corporations, Water utilization corporations, Water control corporations, Conservation district constitutional problems.

The discussion of Oregon's districts reveals their potential uses and drawbacks and provides legislators a background essential for judging the validity of new proposals. A review of the origin of district laws is given. Seven main kinds of districts are described: (1) irrigation districts, (2) drainage districts, (3) water control districts, (4) diking districts, (5) domestic water supply corporations, (6) corporations for the use or control of water, and (7) soil and water conservation districts. Each is discussed in terms of territory, functions and powers, and formation process. The relationship of districts to each other is discussed, including territorial overlap and powers of eminent domain held by each. The relationship of districts to the state is discussed, including the powers and controls of the State Water Resources Board, State Engineer, State Tax Commission, Secretary of State, State Treasurer, and State Soil and Water Conservation Committee. Federal programs carried out by the Soil Conservation Service, the Bureau of Reclamation, and the Corps of Engineers are discussed. Finally, the article considers constitutional problems related to district laws, including legal contradictions in voting requirements and assessments. (Gossen-Chicago)
W69-04034

WATER LAW, PLANNING AND POLICY CASES AND MATERIALS,
Michigan Univ., Ann Arbor.
Joseph L. Sax.
New York, Bobbs-Merrill, 1968, 520. Contemporary legal educational series.

Descriptors: *Water law, *Riparian rights, *Appropriation, *Water management (Applied), Planning, Diversion, Water utilization, Administrative agencies, Federal government, Reclamation, Recreation, Conservation, Pollution abatement, Groundwater, Water pollution, Judicial decisions, Interstate compacts, Legal aspects.

This book was written as a textbook for law students. However, because of its approach to water law, it can also serve as a valuable reference volume. The author treats several current problems in the area of water resources management and, by means of an extensive factual background for each problem, including the influence of other related disciplines such as economics, political science and geography, allows the relevant legal doctrines to emerge from the problem itself. There are relatively few cases; the balance of the book being text and excerpts from articles and documents. The book begins with an introduction to the two basic legal doctrines in water law: riparianism and appropriation. Chapter 1 deals with public planning for water use, specifically the Northwest-Southwest division. Chapter 2 examines the influence of administrative agencies, federal and state, courts, federal management model, and urban water supply demands on managing water use. Recreation, conservation and aesthetics are the topics of Chapter 3. Chapter 4 discusses the problem of water pollution. The Fifth and final chapter concerns the legal problems related to groundwater and other special water sources. (Sisserson-Fla)
W69-04037

WATER QUALITY MANAGEMENT IN THE DELAWARE RIVER BASIN (FEDERAL AND INTERSTATE COMPACT TO SOLVE POLLUTION PROBLEMS),
Delaware River Basin Commission, Trenton, N. J.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04039

MULTIPLE INTERESTS IN RIPARIAN LAND, SUBDIVISION PLATTING, AND THE ALLOCATION OF RIPARIAN RIGHTS,
Illinois Univ., Chicago; and Florida Univ., Gainesville. Coll. of Law.
Sheldon Plager, and Frank E. Maloney.
J Urban Law, Vol 46, No 1, pp 41-66, 1968. 26 p, 89 ref.

Descriptors: *Riparian rights, *High water mark, *Boundaries, *Water rights, Tidal waters, Water level fluctuations, Surveys, Meanders, Bodies of water, Shores, Easements, Water law, Legal aspects, Navigable waters, Judicial decisions, Public rights.
Identifiers: *Plats, Deeds, Right-of-access.

Riparian rights belong to the owner of land which abuts on a navigable waterbody. A problem arises both in deciding if the land abuts on the water, and, if it does, the rights which are thereby acquired. To do this, it is necessary first to decide where the water's edge is; second, to decide if the description of the land makes the water's edge or boundary; third, to decide, where more than one ownership abuts, how the riparian rights are to be allocated. The water's edge is the high water mark, and it is determined by tides, vegetation, and the soil. The question whether the land extends to the water's edge is a matter of intention of the grantor as set out in the deed. In urban areas, where the streets are platted, there is a question whether the street abuts on the water, and whether the public has merely an easement of a fee simple interest in the street. The problems here are whether: (1) the plat shows a water boundary; (2) there are lots abutting on only one side of the street; and (3) where the street is an easement, whether the public has rights of access. Generally, courts hold that plats purporting to withhold riparian rights cannot deny public access rights. (Hoffman-Fla)
W69-04040

THE RELATIONSHIP BETWEEN THE LAWS GOVERNING WATER RIGHTS AND THOSE GOVERNING OTHER NATURAL RESOURCES,
Northcutt Ely.
ABA Section of Mineral and Natural Resources Law (1962 Proceedings) pp 106-112, 1962. 7 p, 20 ref.

Descriptors: *Water rights, *Federal-state water rights conflict, *Riparian rights, *Prior appropriation, State governments, Federal governments, Surface waters, Subsurface waters, Desert Land Act, Legal aspects, Watersheds (Basins), Water law, Navigable waters, Non-navigable waters.

While the main concern of the author is demonstrating the parallel development of the law relative to water rights and oil, gas, and hard minerals, respectively, he places great emphasis on the development of water rights control in this country. Paying particular attention to the western states, the author points out how early conflicts concerning surface water control revolved around the riparian doctrine (that of reasonable use and correlative rights in water) as opposed to the appropriation doctrine ('first in time, first in right'). Strangely enough, the appropriation doctrine became commonplace for surface waters in dry, arid regions while the riparian doctrine was used in more humid regions and for subsurface waters. This is no longer the important conflict. The conflict between the police powers of the states and the power of the federal government over interstate commerce has now come to the fore. Today the arena of dispute is not merely the courts but the floor of the legislature; the parties in interest are no longer private litigants but elements of our federal constitutional system; and the issues to be determined are such as will affect the destiny of entire watersheds. (Logan-Fla)
W69-04041

THE CONVENTION OF THE CONTINENTAL SHELF AND THE NEED FOR ITS REVISION AND SOME COMMENTS REGARDING THE REGIME FOR THE LAND BEYOND,
R. B. Krueger.
Nat Resources Lawyer, Vol 1, No 3, pp 1-18, July 1968. 19 p, 53 ref.

Descriptors: *Natural resources, *Continental shelf, *Oceans, *International law, International waters, Treaties, Oil industry, Law of the sea, Oceanography, Geology, Coasts, Marine geology, United Nations, Exploration, Exploitation, International commissions, Legal aspects, Technology, Legislation.

The Truman Proclamation in 1945 declared the resources of the seabed of the continental shelf contiguous to the United States, subject to its jurisdiction and control. This gave impetus to many claims by coastal nations that certain submarine areas were a part of the continental shelf. The 1958 Geneva Conventions on the Continental Shelf defined the shelf as the seabed adjacent to the coast, but outside the territorial waters, to a depth of 200 meters, or to where the superjacent waters admit of exploitation. This definition has been widely criticized. The author points out that although such an open ended definition has allowed this country to exploit mineral resources beyond the 200 meter depth, it leads to international undersea land grabbing and should be revised. The undersea areas beyond the shelves are presently subject to no regulation and are open to exploitation by anyone. United Nations control and regulation of the deep sea areas has been proposed. The author discusses impending revision of the Convention definition of the shelf as well as its studies and proposals concerning the deep seas. He cites certain goals which might be achieved through international cooperation leading to beneficial use of the seas. (Helwig-Fla)
W69-04042

THE ADMINISTRATION OF THE OUTER CONTINENTAL SHELF LANDS ACT,
Department of the Interior, Washington, D. C. Office of the Solicitor.
Frank J. Barry.
Nat Resources Lawyer, Vol 1, No 3, pp 38-48, July 1968. 11 p, 11 ref.

Descriptors: *Legislation, *Exploitation, *Continental shelf, *Federal government, Exploration, Land tenure, Beds under water, Leases, Mineral industry, Mining, Legal aspects, Oceanography, Oil, Sulphur, Natural gas, Metals, International law, International waters.
Identifiers: Outer Continental Shelf Lands Act, Convention of the Continental Shelf.

The body of law dealing with exploitation of offshore mineral resources centers around the Outer Continental Shelf Lands Act of 1953 and the Convention on the Continental Shelf. The Act creates a federal jurisdiction over the submerged land beyond the three mile limit to the edge of the continental shelf. Federal control is exercised over all exploration and development of resources within the jurisdiction. The seas above the shelf are open to unimpeded international navigation. The International Convention on the Continental Shelf

set depth and distance limits for the shelf and described coastal nations' exclusive rights to exploitation of resources. Questions have been raised concerning the adequacy of these laws. The author notes that the Act was apparently designed to apply only to exploitation of oil, gas, and sulphur, but no hard minerals, in view of the provisions for leasing of submerged lands. Further questions were raised regarding the deep water exploitation beyond the shelf, and the precise limits of national jurisdiction. The author maintains that the present body of law is flexible enough to solve the problems and should not be abandoned. (E. Kelly-Fla)
W69-04043

COMMENT, EMINENT DOMAIN - UNITED STATES V RANDS, 88 S Ct 265 (1967),
Wyoming Univ., Laramie.
K. L. Keene.
LAND AND WATER L REV, Vol 4, No 1, pp 200-208, 1969. 9 p, 47 ref.

Descriptors: *Judicial decisions, *Eminent domain, *Navigable waters, *Condemnation value, Federal government, Evaluation, Condemnation, Riparian rights, Riparian lands, Compensation, Navigation, Public lands, Legal aspects, Political aspects, Property values.
Identifiers: *Navigational servitude, *Commerce clause, Fast land, Inverse condemnation.

In United States v Rands, 88 S Ct 265 (1967) the Supreme Court, in a condemnation suit, denied a riparian owner special compensation for port site property. The Court reasoned that if an owner can demand port site value, he gets the value of a right given by the government in the exercise of its navigational servitude under the commerce clause. In the area of control of navigable waters, exceptions are made to the requirement of just compensation for interference with private property. The government does not pay higher compensation for riparian fast lands whose higher value was caused by its suitability for government use. The court has allowed this noncompensatory taking for two reasons: (1) no property right is taken, rather, only recapture of public right is effected; (2) the government is exercising its paramount navigational power. The author criticizes these reasons, questioning their basis in fact. The policy that the land is held for the public good and should be developed without paying private claims should be replaced by a policy that when the public benefits, the public pays. The widening of the navigational servitude doctrine is inconsistent with the liberal trend in eminent domain laws. (Helwig-Fla)
W69-04044

FISHERIES JURISDICTION BEYOND THE TERRITORIAL SEA - WITH SPECIAL REFERENCE TO THE POLICY OF THE UNITED STATES,
Lewis H. Nomura.
Washington L Rev, Vol 44, No 1, pp 307-334, Oct 1968. 28 p, 129 ref.

Descriptors: *Oceans, *Coasts, *International law, *Jurisdiction, Legislation, Regulation, Zoning, Boundaries (Surfaces), Federal-state water rights conflicts, Fisheries, Commercial fishing, Fish conservation, Exploitation, Federal government, Legal aspects, International waters, Continental shelf, Ecology, Wildlife.
Identifiers: Territorial seas, Exclusive fishing zones, 12 Mile Act, Contiguous zones.

This comment presents and evaluates the use of exclusive fishery zones in the light of the primary interests of conservation of fishery resources. After reviewing the United States policy on the breadth of territorial-sea boundaries, the comment reveals that pressures of increasing exploitation of ground fish, shrimp, and king crab, off the coast of United States by Soviet and Japanese fishing resulted in federal legislation in 1966 establishing a nine-mile fisheries zone contiguous to the territorial sea of the United States. The 12 Mile Act, 16 U S C secs 1091-94 (1966), is analyzed on the basis of measuring procedure, possible conflicts with state jurisdiction, administration and enforcement of laws and regulations, and the Bill's actual effect on American fisheries since 1966. The merits of such legislation are evaluated with respect to conflicting national and international interests. The comment concludes that the accomodation of American and world community interests will not be achieved successfully through use of exclusive fishery zones, and that the greatest likelihood of successful accommodation will result from the use of bilateral and multi-lateral agreements creating specific management regions for ecologically interrelated fish stocks. (Dean-Fla)
W69-04046

A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES: EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
National Science Foundation, Washington, D. C.
For primary bibliographic entry see Field 09D.
For abstract, see .
W69-04048

THE DEVELOPMENT OF OCEAN MINERALS AND THE LAW OF THE SEA,
Consolidated Edison Co. of New York, Inc. New York.
Charles F. Luce.
Nat Resources Lawyer, Vol 1, No 3, pp 29-35, July 1968. 7 p, 1 ref.

Descriptors: *Law of the sea, *Continental shelf, *Coasts, *Boundary disputes, Ownership of beds, Beds under water, Administration, Mining, Exploitation, Water law, International commissions, Mineral industry, Mining engineering, Geological mapping, Subsurface mapping, Legal aspects.

The author states that a rapidly advancing technology is making the resources of the oceans available in growing abundance for exploitation by man. He concludes that, with the steady increase in extraction of minerals from ocean beds beyond the continental shelves, changes in the present legal regime regarding offshore boundaries will soon be required. The nations of the U. N. Commission on Intergovernmental Oceanography, including the United States, have conducted surveys concerning the present state of knowledge of undersea resources and have studied proposals for international cooperation. The author states that this type of action, culminating in some form of international regime to govern the disposition and/or use of mineral laden undersea lands, is essential to avoid power struggles between nations for control of the seas. He points out difficulties in implementation, such as disputes among coastal countries over boundaries and undersea rights, and hazards of locally unregulated offshore operations by foreign powers. He furthur cites difficulties in international administration which must be overcome, such as conflicts of interests over proposed usage and the nature of the legal rights which vest in the user. (Kelly-Fla)
W69-04049

POLLUTION.
Natural Resources Law Newsletter, Vol 1, No 3, pp 1, 5, April 1968. 2 p.

Descriptors: *Oil, *Water quality control, *Legislation, *Ships, Oil industry, Oil wastes, Pollutants, Water pollution sources, Water quality, Federal government, Water pollution control, Water pollution, Boats, Federal jurisdiction, Navigable waters.
Identifiers: Marine vessels, Oil Pollution Act.

This newsletter article directs itself to the problem of the pollution of navigable waters by marine vessel oil discharges. The existing federal law, the Oil Pollution Act of 1924, is said to be weak because gross negligence or willful misconduct must be present to establish a violation. Proposed legislation, which would make the owner or operator of a vessel absolutely liable for all clean-up costs regardless of fault, is criticized for going from one extreme to the other. The President urged that the legislation be broadened to apply to twelve miles offshore and to include spillages of other pollutants. This article discusses the problem of obtaining jurisdiction over the party responsible for spillages. Criticism is also directed at the proposed expansion to include discharges from shore installations, in that they are already covered by other laws. Several considerations are offered, including compulsory insurance, federal clean-up aid, limitation of liability, and special treatment for mobile marine transportation equipment. (C. W. Wheeler-Fla)
W69-04050

ACQUISITION OF RIPARIAN RIGHTS IN NEW YORK,
Theodore R. Lee.
A B A Section of Mineral and Natural Resources Law (1964 Proceedings), pp 13-21, 1964. 9 p, 29 ref.

Descriptors: *Water law, *New York, *Riparian rights, Water resources, Water supply, Right-of-way, Water rights, Alteration of flow, Civil law, Diversion, Fish management, Irrigation water, Legal aspects, Legislation, Municipal water, Natural use, Navigable waters, Obstruction to flow, Prior appropriation, Reasonable use, Relative rights, Riparian land, Riparian waters, Usufructuary right, Water utilization, Wildlife conservation, Hudson River, Public rights, Easements, Natural flow doctrine.
Identifiers: Mohawk River.

This article is a review of the law of riparian rights particularly as they relate to New York State. It briefly describes the various doctrines of riparian rights in effect in the United States, placing emphasis on the common law doctrine. The author discusses some of the issues raised in the New York City water supply proceeding, as well as certain limitations on the rights of riparian owners and some of the objections which have been made to the common law doctrine. Also mentioned is a proposal for changing the common law doctrine by legislation and the current attitude of the New York legislature toward possible changes. The article concludes that the common law doctrine of riparian rights applies generally in New York, although criticized; that the City of New York is required by statute to pay indirect real estate and business damages, as well as direct damages, in riparian proceedings; and that the New York legislature, at the present time, does not seem inclined to relieve the City of that obligation nor to materially change the common law doctrine with respect to payment for riparian rights. (D. Heckerling-Fla)
W69-04051

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
Ernest R. Von Starck.
ABA Section of Mineral and Natural Resources Law (1966 Proceedings), pp 27-30, 1966. 4 p.

Descriptors: *Water management, *Water utilization, *Water supply, *Water shortage, Local governments, Federal government, Water resources, Droughts, Reservoir operation, Utilities, Water demand, Water storage, Water conservation, Water delivery, Water requirements, Northeast U S, Community development, Prior appropriation doctrine, Riparian waters, Reasonable use, Southwest U S.

Until recently, there has been no great water supply problem in the Northeast. With the drought conditions which began in 1962 and are continuing to the present time, the sense of non-involvement in major water supply problems has vanished. The current public water supply problems in the Northeast are due more to past deficiencies in

planning than to present lack of rainfall. The area has an abundance of water which has not been used because of a shortage of adequate facilities for collection, storage treatment, and delivery. Solution to the problem should be sought locally. Federal funds for multipurpose reservoirs in the Northeast will be necessary and will help with local problems, however, the water supply aspects of such projects should be financed and controlled on a regional basis. Federal intervention and ultimate control are neither justified nor desirable. The problem certainly provides no basis for federal legislation which restricts the further expansion of privately owned systems which have proven their ability to render service which encourages by subsidy the extention of the type which this drought has exposed as inefficient. (D. A. Heckerling-Fla)
W69-04052

N Y COMMON LAW AND STATUTORY RIGHTS PROTECTING THE INTERESTS OF THE INDIVIDUAL RIPARIAN OWNER IN THE RECREATIONAL AND AESTHETIC VALUES OF HIS ENVIRONMENT,
Cornell Univ., Ithaca, N. Y. Center for Water Resources and Marine Sciences.
William H. Farnham.
Modernization of Eastern Water Law: New York State: A Case Study (Exhibit C), Nov 22, 1968. 61 p, 337 ref.

Descriptors: *New York, *Riparian rights, *Recreation, *Water utilization, Legal aspects, Legislation, Lakes, Streams, Navigable waters, Boating, Fishing, Swimming, Remedies, Natural use, Riparian land, Eminent domain, Alteration of flow, Reasonable use, Water uses, Public benefits, Dams, Docks, Structures, Social values.
Identifiers: Police power, Aesthetic values, Obstruction to view.

The article discusses in depth the enactment of a 1966 New York Conservation Law. The Law creates two new riparian rights. It specifies: (1) that a riparian owner's view of the water upon which his land abuts shall not be interfered with to an unreasonable degree; and (2) that the natural beauty of such body of water shall not be unreasonably impaired. A discussion of the applicable common law and its interpretation by the courts is set out in detail. The problems which will be raised by the recent legislation are presented. The problem of what is 'unreasonable' should be handled by the use of an 'ordinary reasonable purdent man' standard. The act should be held constitutional as a reasonable exercise of the police power of the state. This argument has been successful in the area of zoning. The author feels this legislation is needed to fill the obvious void in the relevant case law. Public sentiment favors the preservation of scenic beauty, and, in addition, the aesthic value bargained for by the riparian owner when he purchased the property should be protected. (A. Shevin-Fla)
W69-04054

JULES DUPUIT AND THE EARLY THEORY OF MARGINAL COST PRICING,
Texas A and M Univ., College Station.
R. B. Ekelund, Jr.
Jour Pol Econ, Vol 76, No 3, pp 462-471, May/June, 1968. 10 p, 1 fig, 1 tab, 17 ref.

Descriptors: *Pricing, Monopoly, Welfare, Costs, Prices, *Cost-benefit theory, *Demand, Tariff.
Identifiers: Total utility, *Consumers' surplus, Producers' surplus, Price discrimination, *Marginal cost pricing, *Subsidies, Toll.

The purpose of this article is to assess the nature of Dupuit's contribution to welfare theory of marginal cost pricing. It is concluded that although Dupuit has rightful claims as the first cost-benefit economist, he was not a progenitor of the principle. Discovery of a short-run marginal cost principle in Dupuit's writings would require a contrived and incorrect interpretation of his remarks on costs and the efficacy of subsidies. Had Dupuit been equipped with Marshallian period analysis or had he specified or indicated that his bridge studies involved a long-run market period, the fixed and maintenance expenses would have indeed been marginal. A long-run approach, moreover, would have possibly been more in keeping with contemporary practice in cost-benefit studies. Yet Dupuit's early and original insights into welfare theory have provided the necessary backdrop against which an important and fruitful area of modern economics is being enacted. Vital water pricing problems involving short vs. long run cost and marginal vs. average cost criteria have as their basis Dupuit's classical treatment of welfare conditions under marginal cost pricing. (Sokoloff-Rutgers)
W69-04085

FINAL REPORT AS OF MARCH 24, 1967, OF CONCLUSIONS REACHED, LEGISLATION RECOMMENDED AND PROGRESS MADE.
Cornell Univ., Ithaca, N. Y. Center for Water Resources and Marine Sciences.

Report to the N. Y. Temporary State Comm on Water Resources Planning, March 31, 1967. 17 p, 33 ref.

Descriptors: *New York, *Riparian rights, *Riparian land, *Reasonable use, Legislation, Lend tenure, Prior appropriation, Property boundaries, Ownership of beds, Severance, Easements, Watersheds, Access routes, Docks, Navigable waters, Non-navigable waters, Irrigation, Diversion, Relative rights, Water resources development, Judicial decisions, Legal aspects.
Identifiers: *Proposed legislation, *Contiguous land, *Riparian rights transfer.

The Center recommends legislation declaring it to be lawful to commence 'reasonable' harmful activities to further use of riparian land, and that riparian owners may substitute non-riparian land, in the exercise of this privilege. The privilege would not extend to non-riparian owners, and legislation should enumerate factors determinative of reasonableness. Tentative recommendations include legislation allowing transfer of riparian rights with or without land to riparians or non-riparians, with adequate protection for riparians with related rights; present law is inadequate to base such transfers upon. In addition, legislation would supply accurate information readily available to private owners. Further, the recommended legislation would define riparian land and the effects of acquisition of contiguous land. The effect of severance and sale of portions of riparian land so that they no longer border on water are also dealt with. Existing case law supplies scant basis for accurate land classification and determination of related rights. (Harris-Fla)
W69-04105

A STUDY OF SELECTED ASPECTS OF THE POWERS OF NEW YORK STATE OVER THE WATERS OF THE STATE.
Cornell Univ., Ithaca, N. Y. Center for Water Resources and Marine Sciences.

Report to the N. Y. Temporary State Comm on Water Resources Planning, March 31, 1966, 102 p, 172 ref. Cont No C19518.

Descriptors: *New York, *Proprietary power, *Public rights, *Ownership of beds, Canals, Navigation, Compensation, Navigable waters, Non-navigable waters, State governments, Riparian rights, Usufructuary right, High water mark, Low water mark, Public lands, Conservation, New York State Barge Canal, Hudson River, New Jersey, Minnesota, Boundaries (Surfaces), Lake Ontario, St. Lawrence River, State jurisdiction.
Identifiers: *Public trustee doctrine, *Police power, Niagara River, Mohawk River.

The questions considered are: (1) whether the State of New York has proprietary rights or rights as trustee for the public in the waters of the state, as distinct from its police and navigation powers over such waters; (2) whether the state, by virtue of such rights, is authorized to modify riparian rights in furtherance of the public interest. New York's navigational system of canals and large waterways for public use make a definition of the state's authority to alter riparian rights valuable. Prior state power has been based on the navigation or policy powers, with any other confiscation of riparian rights being compensated. An in depth study of New York's statutory and case law on riparian and state water rights leads to the conclusion that the state holds rights in certain waters and beds in public trust, but the extent of the state's powers as trustee are ill-defined. New York law is uncertain as to whether proprietary rights and rights to modify without compensation exist in the state. (Harris-Fla)
W69-04106

CARD V NICKERSON (ACTION FOR DAMAGES FOR OBSTRUCTION OF NATURAL WATER COURSE).
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-04151

KENNEBUNK WATER DIST V MAINE TURNPIKE AUTH (RIPARIAN RIGHTS AND USES).

84 A 2d 433-440 (Me 1951).

Descriptors: *Riparian rights, *Water supply, *Proprietary power, *Maine, Judicial decisions, Water pollution, Competing uses, Municipal water, Reasonable use, Riparian land, Riparian waters, Eminent domain, Turbidity, Water rights, Ownership of beds.
Identifiers: *Turnpike Authority, Brooks.

Plaintiff water company brought suit against defendant authority for damages caused to the public water supply when defendant created a turbid condition in one of the brooks used by the district. A question of prime importance was whether or not the district had a proprietary right to use the waters of the brook as a source of supply. In a prior decision, the state supreme court held that the district did not establish a legitimate proprietary right. The district was allowed to amend certain defects0444444444 before rehearing. The district claimed that since it owned the lower riparian lands, which includes the banks and beds of the brook, it had a proprietary interest in the water. However, in holding for the turnpike authority, the court ruled that the plaintiff's proprietary rights to use the water, stemming from ownership of riparian lands, was restricted to riparian purposes. The use of water for public water supply is not a riparian use. If the use is non-riparian, the right must be acquired by eminent domain or purchase from the upper riparian owners who was the turnpike authority. Furthermore, the court held that the use by the turnpike authority of its own land was reasonable; therefore, it may do all things incidental thereto. (Stewart-Fla)
W69-04152

FLOATING TIMBER.

Me Rev Stat Ann tit 38, secs 971-979 (1965).

Descriptors: *Maine, *Lumber, *Lumbering, Legislation, Industries, Saw mills, Water utilization, Water conveyance, Water rights, Riparian land, Navigable waters, Riparian rights, Banks, Legal aspects.
Identifiers: Penalties (Criminal), Penalties (Civil).

Anyone who converts logs lying in a body of water or on its banks is liable to the owner of the logs and to the state for a specified amount per log. The conversion is larcenous if the taking is for the purpose of delivery to a market or mill; there is a presumption of guilt if the logs have been altered. One guilty of the statutory conversion and/or larceny is also li-

able to the owner in a civil action for double the value of the logs. One may peaceably enter another's mill or raft of logs to search for his lost timber; a specified sum may be awarded in a civil action of such entry is prevented. An owner may drive to the place of market the logs of others, which become intermixed with his own and he is entitled to compensation for so doing. Logs washing upon land may be confiscated by the landowner after a specified waiting period; the log owner may remove his timber upon tender of reasonable compensation to the landowner. Damages are specified for conversion of railroad sleepers, ship knees and cedar timber. Obstruction of timber passage on the Saco River is actionable. (Molica-Fla)
W69-04153

INTERSTATE WATER POLLUTION CONTROL ACT.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04154

ARTICLE ONE, SUBCHAPTER TWO, NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT (DETAILS OF THE COMPACT).
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04155

ARTICLE TWO; SUBCHAPTER TWO; NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMPACT.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04156

PUBLIC FACILITIES FOR BOATS.

Me Rev Stat Ann tit 38 secs 321, 321-A, 322, 323, 324, 325, 326, 327, 328 (Supp 1968-69).

Descriptors: *Maine, *Legislation, *Boating, *Recreation facilities, Boat-launching ramps, Parks, Administration, Administrative agencies, Construction, Operation and maintenance, Financing, Contracts, Legal aspects.

The Director of the Maine State Park and Recreation Commission is empowered to decide where public facilities for boats shall be located and shall construct and maintain them in the waters of the State. The Director may place regulator markers on the waters where hazards exist. For these purposes the Commission or its agents may enter any lands or premises for inspection and it has the authority to (1) exercise police supervision over public facilities, (2) establish rules and regulations, (3) control fires, (4) make leases and other agreements with the United States. The Commission is provided with a fund to carry out its duties. The Commission may charge reasonable fees for the use of facilities to finance their supervision. 10% of the fees may be set aside for maintenance purposes. The Director may lease land for a maximum of 30 years to private individuals on which they may construct restaurants, etc and he may lease from private individuals land or structures, for periods not exceeding 99 years, to construct or maintain boat facilities. (Molica-Fla)
W69-04157

UNLAWFUL DISPOSAL OR TAKING OF BALLAST.
For primary bibliographic entry see Field 05B.
For abstract, see .
W69-04158

HARBOR MASTERS.
Me Rev Stat Ann tit 38, secs 1, 2-5 (1965); Me Rev Stat Ann tit 30, sec 2 (Supp 1968-69).

Descriptors: *Legislation, *Maine, *Port authorities, *Harbors, Boats, Local governments, Public benefits, Channels, Channel improvement, Coastal structures, Municipalities, Legal aspects, Navigation, Boating.
Identifiers: *Harbor masters, Moorings, Penalties (Criminal).

These sections pertain to harbor masters. Section 1 provides for the annual appointment of a harbor master by selectmen of towns. The master shall be subject to all the duties and liabilities of said office as prescribed by law with a fine of $25 for each willful neglect or refusal. The selectman may establish his salary and shall have power to remove him. Section 2 allows municipal officers to make rules for keeping channels open to the passage of vessels and to mark off the boundaries of these channels. The harbor master and his deputy, if appointed, or any other law enforcement officer of the state, may enforce these rules. Section 3 provides that, in all harbors where channel lines have been established, the harbor master may assign mooring positions and determine type of mooring to be used. Section 4 provides that in case of neglect or refusal of the master or owner of a boat to remove or replace his mooring, the harbor master may have it removed or changed and collect $2 for such service. Section 5 allows the harbor master to order any vessel obstructing free movement or safe anchorage of any vessel to move to a position designated by him. Failure to obey this order is a misdemeanor punishable by a fine or imprisonment. If no crew is aboard such vessel or if the master refuses to remove it, the harbor master may place a crew on board to move it and the charge shall be $2 plus the cost of the crew. (Heckerling-Fla)
W69-04159

ARSON.

Me Rev Stat Ann tit 17, sec 153 (1965).

Descriptors: *Maine, *Burning, *Boats, Legislation, Ships, Bridges, Piers, Locks, Fire, Legal aspects.
Identifiers: *Penalties (Criminal).

The statute declares that anyone who willfully and maliciously burns any vessel, bridge, lock or dam shall be punished by imprisonment from one to ten years. (Stewart-Fla).
W69-04163

WATER RESOURCES RESEARCH INSTITUTE.

Ala Code tit 8 secs 266-269 (1967 Supp).

Descriptors: *Alabama, *Research facilities, *Administrative agencies, Legislation, Laboratories.
Identifiers: *Water Resources Research Inst.

The board of trustees of Auburn University is authorized to establish a water resources research institute, which is designated as the state agency to accept federal funds for water resources research. The institute shall be subject to the control of the trustees and president of Auburn University and its programs shall be coordinated with the Geological Survey of Alabama. The results of research conducted by the institute shall be reported or published as the director of the institute may consider suitable and appropriate. (Kahle-Fla)
W69-04168

MCKEE V GAY (BOUNDARY LIMITATION WHEN DEED CONVEYS TO THE LOW WATER MARK).

293 S W 2d 450-452 (Ark 1956).

Descriptors: *Arkansas, *Boundaries (Property), *Ownership of beds, *Low water mark, Judicial decisions, Boundary disputes, Land tenure, Riparian land, Legal aspects, Riparian rights.
Identifiers: Brakes, Deeds.

Defendant held title to land which was shaped like a horseshoe. The deed described the curved boundary, formed by a brake, as beginning at a point at the low water mark of the brake on a line between certain sections and then running along such line between other sections to the low water mark on the north side of the brake, and then right, along the low water mark of the brake, to the point of beginning. The circuit court held that the deed was effective to convey only the land which was contained within the boundaries set out therein. Since his rights were fixed by the description in the deed, defendant was not entitled to claim to the middle of the brake as a riparian owner. (Childs-Fla)
W69-04169

ABOLT V CITY OF FORT MADISON (USE OF PUBLIC LAND BY PRIVATE INDIVIDUAL).

108 NW 2d 263-270 (Iowa 1961).

Descriptors: *Iowa, *Public lands, *Public rights, *Land use, Judicial decisions, Withdrawn land, Cities, Zoning, Industries, Federal Government, Land classification, Land development, Parks, Aesthetics, Eminent domain, Legislation, Legal aspects.

Plaintiff sought to restrain the defendant city from leasing 2.2 acres of a riverfront park for the construction of dock and warehouse facilities. The plaintiff claimed that the proposed lease amounted to allowing land reserved for a public park to be diverted to private use. The decision at trial was for the defendants and this court affirms. The city was laid out per an act of Congress which provided that a quantity of land on the river banks, running the length of the town, be reserved from sale for public use, and remain forever for public use, as public highways, and for other public uses. The city may not devote the land to private use nor dispose of it for other than public uses. The warehouses to be built under the lease are to be public bonded warehouses leased to a private business for a term of years. The fact that the leasee expects to derive profits from the warehouses does not require that his use be deemed private. Projects devoted to a public use are frequently undertaken with a view to private benefit. A legislative determination that lands taken under eminent domain are to be put to public use will not be interferred with by the courts unless it is palpably clear that the use is private in character. The congressional act did not limit the use of the land in question to any particular public use such as a park. An unrestricted dedication can be used for any purpose for which the municipal authorities may determine, as long as it is a public use. (Blunt-Fla)
W69-04171

AN ACT RELATIVE TO EXPANDED STATE ACTIVITY IN THE FIELD OF WATER POLLUTION CONTROL.
For primary bibliographic entry see Field 05G.
For abstract, see .
W69-04178

PETITION OF ALGONQUIN GAS TRANSMISSION CO (GRANTED RIGHTS IN RIVERBEDS).
2 Misc 2d 997, 157 NYS 2d 748 (S Ct 1956).

Descriptors: *New York, *Hudson River, *Easements, *River beds, Judicial decisions, Legal aspects, Utilities, Pipelines, Navigable rivers, Real property, Legal aspects, Ownership of beds, State governments, Assessments, Public benefits.
Identifiers: Franchises.

Petitioner gas company was granted a right to construct a pipeline in and upon a strip of land under the Hudson River. After the construction of the lines, respondent state assessed them as an exercise of a special franchise. The court held that petitioner's claim that the interest it acquired was an easement rather than a franchise was correct and as such it was not subject to an assessment. The state has two separate interests in the river, ownership of

the soil under the water and control over the waters for the benefit of the public. The latter is a sovereign power, but title to the river bed is ownership similar to that of a private owner of a parcel of land. The granting of rights in real estate in the bed of the river is a property right and not an attribute of sovereignty and is therefore an easement. (Molica-Fla)
W69-04182

ENTRY BY TOWN ENGINEER ON PRIVATE LANDS.

N Y Town Law sec 32-a (McKinney 1968). 2 p.

Descriptors: *New York, *Legislation, *Investigations, *Bodies of water, Land, Local governments, Real property, Surveys, On-site data collections, Legal aspects, Boreholes, Drilling.

The town engineer, or any of his agents, may enter upon any lands, waters or waterways, public or private, within the town to make surveys, examinations or investigations necessary to the performance of his duties. Any alterations, such as test pits or test borings made to the land, must be refilled, and the real property must be restored to its previous condition. (Sisserson-Fla)
W69-04184

LICENSING DIVERSION AND USE OF WATER FOR POWER.
N Y Conserv Law secs 501 (9), 502 (McKinney 1967).

Descriptors: *New York, *Eminent domain, *Diversion structures, *Permits, Legislation, Jurisdiction, Legal aspects, State jurisdiction, United States, Diversion, Power plants, Hydroelectric plants, River beds, Water management (Applied), Water control, Canals, Streams.

The Commission of Water Resources may issue licenses to public utilities to build power plants on waters in which the State of New York has a proprietary right or interest. The licenses may authorize the utility to divert water or condemn land, including river bottoms by eminent domain if necessary. The licenses must be signed by the governor. The approval of the federal authorities is further required where the United States has also assumed jurisdiction of navigable waters. (Watson-Fla)
W69-04188

RESERVATION OF STATE CONTROL OVER WATER POWER.
N Y Conserv Law sec 500 (McKinney 1967).

Descriptors: *New York, *Legislation, *Regulation, *Water rights, Control, Legal aspects, Jurisdiction, State jurisdiction, Water utilization, Riparian rights.

The State of New York reserves control over all waters in which it has proprietary ownership of the flow whether exclusive or concurrent with another jurisdiction. Any person who takes, diverts, appropriates, or otherwise uses these waters remains subject to the power and control of the state for the purposes of regulating, licensing, controlling, or terminating the use. The state may also exact a rent or charge for the use. (Watson-Fla)
W69-04189

CREATION OF WATER RESOURCES COMMISSION.
N Y Conserv Law sec 410 (McKinney 1967).

Descriptors: *New York, *Water resources, *Water policy, *Administrative agencies, Legislation, Water resource development, Conservation, Planning, Water conservation.

The Water Resources Commission, under the Conservation Department, is responsible for the integration of all water resource policy and planning activities. It has seven regular members and four advisory members appointed by the Governor. The advisory members must be comprised of a representative of: (1) industry, (2) state political subdivisions, (3) agricultural interests, (4) sportsmen. The advisory members are entitled to participate in all meetings but are not entitled to vote on any matters before the commission. (Molica-Fla)
W69-04190

WATER RESOURCES - LEGISLATIVE FINDINGS.
N Y Conserv Law sec 400a (McKinney 1967).

Descriptors: *New York, *Water resources development, *Water pollution control, *Water conservation, Legislation, Planning, Water resources, Water policy, Conservation, State governments, Public benefits, Legal aspects, Water supply, Water demand, Water control, Regulation, Economics, Administrative agencies.

The State of New York, pursuant to legislative findings, is deemed to have exclusive sovereign power in the control and regulation of water resources of the state except to the extent of any delegation of authority to the United States. The State recognizes that its water resources are important for economic growth, that an adequate supply of water is essential to the well being of its people and that the demands for water are on the increase. The State seeks to preserve all water life and condemn unreasonable and unregulated interference with its bodies of water which contribute to pollution. The Water Resources Commission has classified the waters of the state and is undertaking comprehensive planning to conserve and develop water resources. The use of water for domestic and municipal purposes has priority over its use for other purposes. (Molica-Fla)
W69-04191

BURNS V GARDNER (SUIT FOR DEATH OF CHILD BY DROWNING).
244 NC 602, 94 SE 2d 591-592 (1956).

Descriptors: *North Carolina, *Lakes, *Artificial watercourses, *Drowning, Judicial decisions, Water law, Hazards, Recreation, Safety, Swimming, Ponds, Lakes, Legal aspects.
Identifiers: Negligence.

The administration of the estate of a ten year old girl brought an action in negligence against the owners of an artificial lake, into which the girl had fallen and drowned. The trial court entered a judgment of non-suit and the Supreme Court of North Carolina affirmed. The supreme court held, in a per curiam decision, that the evidence was insufficient to warrant submission to a jury. The supreme court additionally stated that a person has the right to maintain an unenclosed pond or pool on his premises, and it is not an act of negligence to do so. (Watson-Fla)
W69-04192

ACTIONS TO DETERMINE TITLE TO RIPARIAN LANDS AND LANDS UNDER WATER.

N J Stat Ann secs 2A:62-23 to 2A:62-26 (1968).

Descriptors: *New Jersey, *Legislation, *Riparian land, *Ownership of beds, Water law, Beds, Administrative agencies, Navigation, Riparian rights, Streambeds, Real property, Legal aspects, State governments, Grants.
Identifiers: Title.

When a grant or conveyance in fee of riparian lands or lands underwater has been made by the State of New Jersey, or any of its agencies, to any person, or his lessee, who is in possession of the lands and the state denies the validity of the grant and desires to contest it, the Attorney General may maintain a suit in the superior court on behalf of the state to settle the matter. Upon application of either party, a jury trial shall be directed to try the validity of any claim to the affected lands. The final determination and judgment of the court shall fix and settle the rights of the parties in the affected lands, which shall be binding upon all the parties to the action. If the judgment of the court is in favor of the state, the court shall determine upon what equitable terms the grant or conveyance in fee shall be set aside and declared of no effect. (Watson-Fla)
W69-04195

NEW JERSEY AND DELAWARE - TERRITORIAL LIMITS AND JURISDICTION.

N J Stat Ann secs 52: 28-34 to 52: 28-38, 52: 28-40 to 52: 28-42 (1955).

Descriptors: *Delaware River, *New Jersey, *Boundaries (Property), *Interstate compact, Legislation, Delaware, Jurisdiction, Interstate rivers, Shellfish, State government, Riparian rights.
Identifiers: Criminal law.

Sections 52: 28-34 through 52: 38-38 and 52: 28-40 to 52: 28-42 pertain to the relationship of New Jersey and Delaware as regards the Delaware River. Section 52: 28-34, the Preamble, refers to a meeting in 1905 of commissioners from New Jersey and Delaware which produced a compact to prevent further controversies over the Delaware River and to eliminate those already existing. Section 52: 28-35 provides for criminal service of process issued by New Jersey against anyone committing a crime on the eastern half of Delaware River and allows service to be made anywhere on the river. Section 52: 28-36 allows reciprocal service of process by Delaware for crimes committed on the western half of the river. Section 52: 28-37 makes the river a common fishing grounds for the inhabitants of the two states. Section 52: 28-38 sets up a joint commission to draft laws relative to fishing and ascertaining a dividing line between the river and the bay separating the two states. Section 52: 28-40 provides that the shellfish industry is not affected by this agreement. Section 52: 28-41 allows each state to continue to exercise its riparian jurisdiction. Section 52: 28-42 provides that each state's rights in the Delaware River shall be preserved. (Heckerling-Fla)
W69-04196

LICENSING OF VESSELS.

N J Stat Ann secs 50: 3-1, 50:3-3 (1955).

Descriptors: *New Jersey, *Commercial shellfish, *Permits, *Delaware River, Legislation, Commercial fishing, Bays, Beds, Boats, State jurisdiction.

These sections pertain to the licensing of vessels for the taking of shellfish. Section 1 provides that no vessel shall be used in the catching of oysters in the Delaware River, Delaware Bay or Maurice Cove without a license for that purpose. Such license shall be issued by the Chief of the Department of Maurice River Cove, duly certified, to the captains of the vessels entitled thereto. Section 3 provides that the vessels must be owned by citizens and actual residents of this state. No vessel owned wholly or in part by a non-resident and which is licensed to take oysters in another state within the same year shall be licensed in this state. The captain of the vessel shall swear an oath as to this information. (Heckerling-Fla)
W69-04197

LEASING OF LANDS FOR SHELLFISH CULTURE.
N J Stat Ann secs 50:1-23--28, 50:1-30--33 (1955); N J Stat Ann secs 50:1-23 (Supp 1968).

Descriptors: *New Jersey, *Shellfish, *Beds, *Tidal waters, Legislation, Commercial fishing, Oysters, Commercial shellfish, Agriculture, Leases, State jurisdiction, State government, Public health, Marine fisheries, Mapping, Surveys, Subsurface mapping.
Identifiers: *Shellfish cultures.

The Shell Fisheries Council is empowered to lease any state lands under tidal waters, the land to be used exclusively by the lessee for cultivating oysters. This board's powers in this area are exclusive. Only citizens and actual residents of the state shall be granted a license, and the Council must require applicants to file an oath to this effect. This board has the power to set the length of the lease, the rental price, and the size of the leased ground. This board shall have the leased lands measured, marked and mapped, the expenses to be paid by the applicant. This board may lease any lands that have been condemned by the state department of health. This board may make rules and regulations for the removal and distribution of shellfish from the leased land. All leases issued before July 4, 1931 are continued. This law shall not prevent the catching of floating fish from tidal waters. (Heckerling-Fla)
W69-04198

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION-HUTTON BRANCH AND COOKS BRANCH, DALLAS COUNTY, TEXAS.
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03707

FLOOD PLAIN INFORMATION - VOLUME IV OF DENVER METROPOLITAN REGION, COLORADO.
Corps of Engineers, Omaha, Nebr.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03708

FLOOD PLAIN INFORMATION OF CONGAREE CREEK AND SIX MILE CREEK IN LEXINGTON COUNTY, SOUTH CAROLINA.
Corps of Engineers, Charleston, S. C.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03709

FLOOD PLAIN INFORMATION-PETERS CREEK AND LICK RUN, ROANOKE, VIRGINIA.
Hayes, Seay, Mattern and Mattern, Roanoke, Va.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03710

PRELIMINARY FLOOD PLAIN INFORMATION-CHATTAHOOCHEE RIVER, BUFORD DAM TO METROPOLITAN ATLANTA, GEORGIA.
Corps of Engineers, Mobile, Ala.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03711

FLOOD PLAIN INFORMATION - FOUNTAIN CREEK, PUEBLO, COLORADO.
Corps of Engineers, Albuquerque, N. Mex.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03712

FLOOD PLAIN INFORMATION-OUACHITA RIVER, CAMDEN, ARKANSAS.
Corps of Engineers, Vicksburg, Miss.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03713

FLOOD PLAIN INFORMATION-CUMBERLAND RIVER AND OBEY RIVER, CELINA, TENNESSEE.
Corps of Engineers, Nashville, Tenn.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03714

FLOOD PLAIN INFORMATION, CHRISTINA RIVER, MUDDY AND BELLTOWN RUNS, NEW CASTLE COUNTY, DELAWARE.
Corps of Engineers, Philadelphia, Pa.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03715

OREGON'S WATER-MANAGEMENT DISTRICTS,
Oregon Univ., Eugene. School of Law.
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04034

SIMULATION OF A NATIONAL FLOOD INSURANCE FUND,
Florida Univ., Gainesville; and Harvard Univ., Cambridge, Mass.
For primary bibliographic entry see Field 06A.
For abstract, see .
W69-04138

6G. Ecologic Impact of Water Development

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

07. RESOURCES DATA

7B. Data Acquisition

STAGE MEASUREMENT AT GAGING STATIONS,
Geological Survey, Washington, D. C.
Thomas J. Buchanan, and William P. Somers.
Geol Surv Tech Water Resources Invest, Book 3, Chapter A7, 1968. 28 p, 27 fig, 6 ref.

Descriptors: *Stream gages, *Instrumentation, Gaging stations, Telemetry, Water levels, Potentiometers.
Identifiers: Technical manuals, Stage measurement.

Continuous measurements of stream stage are used in determining records of stream discharge and are useful in themselves for use in designing structures affected by stream elevation or in planning the use of flood plains. Instruments and structures commonly used in obtaining a record of stream stage are described. The topics covered in detail are water-level sensors, water-stage recorders, stilling wells, instrument shelters, telemetering systems, nonrecording gages, operation of stage gages, and special-purpose gages. (Knapp-USGS)
W69-03721

INFRARED AERIAL SURVEYS IN ENVIRONMENTAL ENGINEERING,
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio; and Oklahoma State Univ., Stillwater. School of Civil Engineering.
R. V. Matalucci, and M. Abel-Hady.
ASCE Proc, J Sanit Eng Div, Vol 94, No SA6, Pap 6277, pp 1071-1084, Dec 1968. 14 p, 8 fig, 19 ref.

Descriptors: *Air pollution, *Thermal pollution, *Infrared radiation, *Remote sensing, *Mapping, Environmental engineering, Temperature, Spectroscopy, Technology, Methodology.
Identifiers: *Mapping techniques, Thermal anomaly.

An illustrated review is given of the basic principles related to the nature of IR radiation and the problems associated with its atmospheric attenuation. Some of the differences between IR photography and imagery are analyzed, and illustrations are used to demonstrate techniques for locating thermal water pollution by IR sensing. Stream valleys and subsurface drainage patterns are distinctly shown by IR imagery, which can also be used for locating buried conduits and utility systems. The potential application of IR surveys for detecting and tracing air pollution is discussed. (Lang-USGS)
W69-03744

GENERAL FIELD AND OFFICE PROCEDURES FOR INDIRECT DISCHARGE MEASUREMENTS,
Geological Survey, Washington, D. C.
M. A. Benson, and Tate Dalrymple.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A1, 1967. 30 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Discharge measurement, *Stage-discharge relations, Mannings equation, Peak discharge, Surveys, Profiles.
Identifiers: Technical manuals, Indirect discharge measurements.

The discharge of streams is usually measured by the current-meter method. During flood periods, however, it is frequently impossible or impractical to measure the discharges by this method when they occur. Consequently, many peak discharges must be determined after the passage of the flood by indirect methods, such as slope-area, contracted-opening, flow-over-dam, and flow-through-culvert, rather than by direct current-meter measurement. Indirect methods of determining peak discharge are based on hydraulic equations which relate the discharge to the water-surface profile and the geometry of the channel. A field survey is made after the flood to determine the location and elevation of high-water marks and the characteristics of the channel. Detailed descriptions of the general procedures used in collecting the field data and in computing the discharge are given in this report. Each of the methods requires special procedures described in subsequent chapters. (Knapp-USGS)
W69-03748

MEASUREMENT OF PEAK DISCHARGE AT WIDTH CONTRACTIONS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
Howard F. Matthai.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A4, 1967. 44 p, 34 fig, 4 ref.

Descriptors: *Discharge measurement, *Peak discharge, *Stage-discharge relations, Control, Flow around objects, Velocity, Hydraulics.
Identifiers: Technical manuals, Indirect discharge measurements, Channel width contractions.

U. S. Geological Survey procedures for measuring peak discharges using open-channel width contractions are described. Field and office procedures limited to this method are described. The discharge equation based on the continuity and energy equations between an approach cross section and the contracted section under a bridge or contraction is

given. Contractions are classified into 4 geometric types. Discharge coefficients and computation procedures are given with a complete facsimile example of computation of a contracted-opening measurement. Additional procedures are given for multiple-opening contractions.
W69-03753

THE MOVEMENT OF BEACH SAND,
University of Southern California, Los Angeles. Dept. of Geology.
For primary bibliographic entry see Field 02J.
For abstract, see .
W69-03754

GEOLOGIC ORBITAL PHOTOGRAPHY: EXPERIENCE FROM THE GEMINI PROGRAM,
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.
Paul D. Lowman, Jr.
Goddard Space Flight Center, Pap X-644-68-228, Greenbelt, Md, June 1968. 34 p, 10 fig, 2 tab, 44 ref.

Descriptors: *Aerial photography, *Geologic investigations, Geology, Satellites (Artificial), Photographic equipment, Photographs, Terrain, Geological surveys, *Photography, Oceanography, Terrain analysis, Geography, *Geologic mapping, Bibliographies.
Identifiers: Color film, *Color photography, Infrared photography, Photographic analysis, Space vehicles, Photointerpretation.

Most Gemini flights carried a terrain photography experiment to obtain small-scale color photographs of selected land and ocean areas with 70 mm-hand held cameras. Photographic equipment included Hasselblad 500-C and SWC cameras, and the Maurer 70 mm-Space Camera with 38-, 80-, and 250-mm focal length lenses. Most pictures were taken with Ektachrome; Ansochrome D-50 and Ektachrome infrared film was also used. Specific geologic applications of the Gemini photographs include: (1) study and remapping part of northern Baja California, Mex; (2) study of tectonics and geology at northern Chihuahua, Mex; (3) unsuccessful search for the Texas Lineament; (4) study of a regional dune-fracture pattern surrounding the Tibesti massif in Chad and Libya; and (5) study of the theory that the Arabian Sea is a sphenochasm formed by continental drift. The terrain photography experiment is described and specific applications of the Gemini pictures are presented. The experiment was highly successful, demonstrating the geologic value and feasibility of orbital photography. Major advantages and disadvantages are discussed. The most promising uses appear to be in regional geologic mapping, tectonics, sedimentation, planning of geologic and geophysical field work, and interpretation of regional geophysical surveys. (USBR)
W69-03784

THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
Central Metallurgical Labs., Whetstone (England).
For primary bibliographic entry see Field 08G.
For abstract, see .
W69-03787

HYDRAULIC LOAD-CELL LYSIMETER, CONSTRUCTION, CALIBRATION, AND TESTS,
Wisconsin Univ., Madison.
T. A. Black, G. W. Thurtell, and C. B. Tanner.
Soil Sci Soc Amer Proc, Vol 32, No 5, pp 623-629, Sept-Oct 1968. 7 p, 6 fig, 1 tab, 13 ref.

Descriptors: *Lysimeters, *Evapotranspiration, *Evaporation, Moisture content, Percolation, Soil water, Insulation, Construction, Sands, Test procedures, Tanks (Containers), Soil temperature, Calibrations, Energy balance, Soil science, Soil moisture, Measuring instruments.
Identifiers: *Load cells, Weight loss, Thermal balance, Plastic foam, Pressure transducers.

The construction and calibration of two 35-metric ton, hydraulic load-cell lysimeters with suction drainage systems are described. The butyl-nylon load cells contain an ethylene glycol-water mixture; pressures are measured with a capacitive pressure transducer. Lysimeter sensitivity is 0.02 mm evaporation. Daily evaporation from the lysimeter and the 2 independent micrometeorological methods agreed to within 5%. Lysimeter measurements of evaporation from bare soil during summer lagged measurements using the 2 other methods by almost 1.5 hr. Differences between the lysimeter thermal regime and that in the surrounding soil accounted for the lag. By using foam plastic insulation on the tank walls, thermal regime differences were minimized. (USBR)
W69-03793

THEORY OF MEASUREMENT,
Princeton Univ., N. J.
Gerard J. Born, and Enoch J. Durbin.
Instrum Contr Syst, pp 63-67, Nov 1968. 5 p, 7 fig, 1 tab.

Descriptors: *Measurement, *Measuring instruments, *Errors, Sensors, Statistics, Sensitivity, Instrumentation, Transducers, Hysteresis.
Identifiers: Static instrumental error, Standard deviation, Validity, Resolution, Accuracy, *Metrology.

Basic metrology is reviewed and instrument elements are discussed. Measurement consists of obtaining a value of a physical quantity by comparison to a reference; a measurement system may include a comparator, a reference, a gain element, and a transducer or converter. Evaluation of a measurement technique is based upon possible error reduction. The static error precision of an instrument arises from reading, characteristic, and environmental errors. The total error may be measured by the root mean square of the component errors. Conditions for the validity of the root mean square error are discussed; when the total root mean square error is known, the most probable value of the measurement can be estimated. Instrument performance is evaluated in terms of resolution, precision, and accuracy. (USBR)
W69-03800

WATER FLUX IN MOIST SOIL: THERMAL VERSUS SUCTION GRADIENTS,
Department of Agriculture, Washington, D. C.
For primary bibliographic entry see Field 02G.
For abstract, see .
W69-03883

MEASUREMENT OF NATURAL EVAPORATION: COMPARISON OF GRAVIMETRIC AND AERODYNAMIC METHODS,
British Meteorological Office, Cambridge (England). Research Unit.
For primary bibliographic entry see Field 02D.
For abstract, see .
W69-03891

SALT PENETRATION TECHNIQUE FOR SEEPAGE MEASUREMENT,
Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
For primary bibliographic entry see Field 04A.
For abstract, see .
W69-03935

FLUOROMETRIC PROCEDURES FOR DYE TRACING,
Geological Survey, Washington, D. C.
James F. Wilson, Jr.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A12, 1968. 31 p, 15 fig, 1 tab, 28 ref.

Descriptors: *Dye releases, *Fluorometry, Tracers, Surface waters, Groundwater movement, Instrumentation, Measurement.
Identifiers: Technical manuals, Dye tracing.

The current fluorometric procedures used by the U.S. Geological Survey in surface streams for such applications as time-of-travel measurements, dispersion studies, and discharge measurements are described in a technical manual. Rhodamine B is the dye generally recommended for the time-of-travel and dispersion measurements, and Rhodamine WT for discharge measurements and groundwater applications. Pontacyl Pink is a good tracer dye, but is much more expensive than the others. A fourth dye, fluorescein, is of marginal value as a surface-water tracer. Important properties of the dyes include fluorescence, temperature effects, pH effects, fluorescence quenching, photochemical decay, physical sorption, biological effects, and spectral characteristics. The strong orange fluorescence of Rhodamine B, Rhodamine WT, and Pontacyl Pink in weak solutions is easily isolated and detected in a filter fluorometer. Fluorometer components and operation and calibration of the most commonly used fluorometer are described. Prepared standards of known dye concentration may be used to determine the linear relationship of fluorometer readings to concentration. Readings for samples containing dye must be corrected for background and temperature effects before conversion to concentration. Light scattered by turbidity of the sample often is the most troublesome component of background. Aerial photography of the visible dye cloud is a potentially useful supplement to fluorometric analysis in some studies. (USGS)
W69-03944

MEASUREMENT OF PEAK DISCHARGE AT DAMS BY INDIRECT METHODS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03945

SP LOG INTERPRETATION IN SHALY SANDS,
Koninklijke/Shell Exploratie en Produktie Laboratorium, Rijswijk (Netherlands).
L. J. M. Smits.
J Soc of Petrol Eng, Vol 8, No 2, pp 123-136, June 1968. 14 p, 9 fig, 3 tab, 18 ref.

Descriptors: *Electrical well logging, *Potentiometers, Geologic formations, Resistivity, Exploration, Logging (Recording), Porosity, Permeability, Membrane processes, Osmosis, Diffusion, Salinity.
Identifiers: SP log interpretation, Shaly sand log interpretation, Potential logging, Streaming potentials, Membrane potentials.

A theoretical equation is developed describing membrane potentials of shaly sands as a function of the cation-exchange capacity per unit pore volume of the rock and saturating water salinity. This equation is based on the same simple physical model as that employed earlier describing the electrical conductivity of shaly sands. Experiments conducted with NaCl solutions showed that the equation is obeyed, except in the case of saturated salt solutions where minor deviations were observed. A possible explanation is given for this decrepancy. As the clay content and the porosity of shales may vary appreciably, shale membrane potentials also vary. It was found that membrane potentials of shales can be calculated accurately with the aid of the same theory. Consequently, changes in membrane potentials can be accounted for by simple measurement of cation-exchange capacities per unit pore volume of both shales and shaly sands. Charts are given to facilitate interpretation of the electro-chemical part of the SP in terms of cation-exchange capacities and the salinities of mud filtrate and formation water.
W69-03946

TREE-RING ANALYSIS: A TOOL FOR WATER RESOURCES RESEARCH,
Arizona Univ., Tucson. Lab. of Tree-Ring Research.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03963

MEASUREMENT OF PEAK DISCHARGE BY THE SLOPE-AREA METHOD,
Geological Survey, Washington, D. C.
Tate Dalrymple, and M. A. Benson.
Geol Surv Tech Water-Resources Invest, Book 3, Chapter A2, 1967. 12 p, 7 fig, 1 tab, 3 ref.

Descriptors: *Discharge measurement, *Open channels, *Mannings equation, *Stage-discharge relations, Roughness (Hydraulic), Discharge (Water).
Identifiers: Technical manuals, Slope-area discharge measurements.

The application of the Manning equation to measure peak discharge in open channels is described. Field and office procedures limited to this method are discussed. Selection of reaches and cross sections is detailed, discharge equations are given, and a complete facsimile example of computation of a slope-area measurement is also given. (USGS)
W69-03967

ROUGHNESS CHARACTERISTICS OF NATURAL CHANNELS,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02E.
For abstract, see .
W69-03978

RESEARCH ON THE MORPHOLOGY OF PRECIPITATION AND RUNOFF IN TEXAS,
Texas A and M Univ., College Station. Water Resources Inst.
For primary bibliographic entry see Field 02B.
For abstract, see .
W69-04135

7C. Evaluation, Processing AND Publication

COMPUTATIONAL SCHEMES FOR THE BOUSSINESQ EQUATION,
California Univ., Davis. Dept. of Water Science and Engineering.
George Terzidis.
ASCE Proc, J Irrig and Drainage Div, Vol 94, No IR4, Pap 6276, pp 381-389, Dec 1968. 9 p, 2 fig, 13 ref, append.

Descriptors: *Equations, *Numerical analysis, *Groundwater, *Unsteady flow, Mathematical studies, Continuity equation, Digital computers, Stability.
Identifiers: *Boussinesq equation, *Nonlinear differential equations, Stability methods, Boundary conditions, Finite difference methods.

A general analytical solution of Boussinesq's equation subjected to general initial and boundary conditions has not yet been found because of its nonlinearity. However, numerical methods may be used to obtain an approximate solution of the mixed boundary value problem of this equation. A general computational scheme is constructed by using a weighting factor, Theta between 0 and 1, in the computational net and expanding the involved functions in Taylor's series. The stability analysis of this general computational scheme is studied and the general criterion of stability as a function of the weighting factor is derived. Several nonlinear difference schemes and their criteria of stability are derived for different values of the weighting factor.
W69-03937

OPTIMAL IDENTIFICATION OF NONLINEAR HYDROLOGIC SYSTEM RESPONSE MODELS BY QUASILINEARIZATION,
California Univ., Los Angeles.
For primary bibliographic entry see Field 02A.
For abstract, see .
W69-03958

08. ENGINEERING WORKS

8A. Structures

GEOLOGICAL CONSIDERATIONS IN THE DESIGN OF RESERVOIR SEEPAGE CONTROL SYSTEMS,
Harry R. Cedergren.
Pap, Symp Reservoir Leakage Ground Water Constr, Ass Eng Geol Nat Meet, Seattle, Wash, 1968. 21 p, 3 fig, 5 ref.

Descriptors: *Seepage, Seepage losses, Reservoir design, Hydraulic conductivity, Permeability, *Reservoir leakage, Reservoirs, Geology, Earth dams, Geologic formations, Groundwater recharge, Embankments, Groundwater movement, *Drainage systems, Drainage wells, Drainage, Dam design, Drainage water, Engineering geology, Dam foundations.
Identifiers: *Seepage control, Geologic defects, Drain curtains, Toe drains.

Designing ground-water control systems for reservoirs is a matter of prying into the earth's secrets, using all available experience and intuition, designing systems on the basis of all available information, and following up by carefully observing the completed works. Examples illustrate the manner that variations in geologic conditions in formations under and around reservoirs can influence basic seepage patterns and the overall requirements for drainage systems to control seepage. The importance of providing adequate hydraulic conductivity in drains for estimated seepage quantities is discussed. To illustrate designing for hydraulic capacity, a drainage system design is given for a weighted buttress fill that is used to stabilize an embankment. The drainage system includes a sloping blanket drain, a line of vertical wells, and the outlet blanket. This example demonstrates the engineering and economic advantages of graded filters for drains in reservoirs and other engineering works having important seepage control requirements. (USBR)
W69-03763

PREVENTION OF VORTICES AT INTAKES,
Ministry of Technology, Wallingford (England).
H. O. Anwar.
Water Power, Vol 20, No 10, pp 393-401, Oct 1968. 9 p, 17 fig, 1 tab, 5 ref.

Descriptors: *Vortices, *Intakes, *Intake gates, Intake structures, Fluid flow, Hydraulics, Flow around objects, Flow characteristics, Air entrainment, Flow control, Models, Hydraulic models, Apparatus, Charts, Eddies, Reynolds number, Discharge coefficients, Sudden enlargements, Flow, Orifice flow, Submergence.
Identifiers: Eddy currents, Borda flow.

Theoretical and experimental results of an investigation into various types of flow occurring at an intake are presented and the prevention of swirl and vortex formation discussed. Two types of flow (radial and swirl) are examined. The formation of a vortex is shown to depend on depth of submergence and on swirl of the oncoming flow. Graphs are presented to predict vortex formation; the parameters of the graphs can be calculated or measured on models. (USBR)
W69-03788

HOTZENWALD PUMPED-STORAGE SCHEME,
E. Pfisterer.
Water Power, Vol 20, No 9 and 10, pp 349-355 and 407-413, Sept/Oct 1968. 13 p, 20 fig, 1 ref.

Descriptors: *Pumped storage, *Hydroelectric power, *Underground powerplants, Reservoirs, Dams, Intake structures, Intakes, Turbines, Hydraulic turbines, Pump turbines, Underground structures, Tailrace, Cables, Tunnels, Shafts (Excavations), Tunnel construction, Torque.
Identifiers: West Germany, Pressure shafts, *Hotzenwald Pump Stor (West Germany), Sackingen Power Sta (West Germany), Generator-motors.

The Sackingen 360-mw underground pumped-storage plant is a part of the Hotzenwald hydropower development in the Black Forest of West Germany. The plant is connected to a 2-million-cu m upper reservoir by a 400-m-high vertical pressure shaft from which branches lead to turbines and pumps. Below the machines, similar branches form the tailrace distribution lines terminating in the 2000-m-long tailrace tunnel leading to the lower reservoir on the Rhine. The turbine-alternator/motor-pump sets are described. These sets are unique in having a torque converter between the alternator/motor and the pump and an automatic coupling between the alternator/motor and the turbine. Two other planned units of the Hotzenwald hydropower scheme (the Strittmatt and Hornberg) as well as the Schluchsee scheme are discussed. (USBR)
W69-03789

NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT,
Northeast Utilities Service Co., Hartford, Conn.
S. Hale Lull, and Antonio Ferreira.
Proc Amer Soc Civ Eng, J Power Div, Vol 94, No PO2, pp 199-215, Nov 1968. 17 p, 8 fig.

Descriptors: *Pumped storage, Pump turbines, *Peak power, Powerplants, Peak loads, Peaking capacities, Pumping plants, Underground powerplants, *Hydroelectric power, Multiple-purpose reservoirs, Project planning, Tunnels, Surges, Recreation, Municipal water.
Identifiers: Pump-generators, Northfield Mountain Proj (Mass).

The Northfield Mountain Pumped Storage Project will be a source of economical peaking power for New England, as area of high transportation and fuel costs. In addition to the project's capability to hydraulically store surplus power from conventional thermal and nuclear baseload power sources, the 1,000,000-kw facility will provide assured reserve (spinning reserve) capacity at extremely short notice. Emanating from this pumped storage project are accrual flexibilities (in the form of multipurpose use) that will provide optimum utilization of this project site. Part of the storage will be retained at all times to meet possible emergencies. The operating cycle of the remaining storage is one week. A portion of the daily water releases will be pumped back into the reservoir the following night, with the remaining portion being restored over the weekend. The pressure conduit length was kept short by locating the powerhouse underground adjacent to the upper reservoir. This minimizes response time to rapid changes in system demand. Civil, electrical, and hydraulic features of the system are described. (USBR)
W69-03794

DISCHARGE FACILITIES AT HELLS CANYON DAM,
Bechtel Corp., San Francisco, Calif; and Idaho Power Co., Boise, Idaho.
Joseph T. Gilchrist, and Donald E. Barclay.
Proc Amer Soc Civ Eng, J Power Div, Vol 94, No PO2, pp 161-176, Nov 1968. 16 p, 13 fig, 2 tab.

Descriptors: Discharge (Water), *Diversion tunnels, Diversion dams, Diversion structures, *Spillways, Hydraulic models, Tunnels, *Gravity dams, *Concrete dams, Hydroelectric power, Fish handling facilities, Energy dissipation, Powerplants, Turbines, Tunnel linings, Hydraulic gates, Intake structures, Hydraulic structures.
Identifiers: Hells Canyon Dam (Idaho), Energy dissipators.

Designing Hells Canyon Dam on the Snake River for the Idaho Power Co required careful considera-

tion in arranging the diversion, power, and spillway facilities to fit within the deep narrow gorge. The arrangement of each feature is described. The dam is a straight concrete gravity structure. The 1700-ft-long diversion tunnel is concrete lined and has a 40-ft-dia horseshoe section to handle 60,000 cfs. The 3-unit powerplant, with 391,500-kw nameplate capacity, is notched into left abutment rock and overlaps the toe of the dam. Energy of 300,000-cfs discharge over the center section spillway is dissipated by a combination of concrete nappe deflectors and a submerged roller bucket. Fish trapping facilities adaptable to the 48-ft tailwater fluctuation are mounted in an aluminum barge floating in the tailrace. Hydraulic model studies were made of the spillway and the entire project to determine discharge capacities and characteristics of various features. (USBR)
W69-03795

POWERS V LAWSON (APPLICABILITY OF DAM ALTERATION STATUTE).

136 A 2d 613-616 (RI 1957).

Descriptors: *Rhode Island, Judicial decisions, Backwater, Dams, *Mill dams, Flood control, Dam construction, Mosquitoes, Water pollution, Damages, Administrative agencies, State governments, *Legislation, *Public health, Legal aspects, Mud flats, Ponds, Planning.
Identifiers: Dam removal, Dam alteration.

A Rhode Island statute authorized the Chief of Harbors and Rivers to issue an order requiring dam owners to file plans and specifications of construction or substantial alteration of a dam. The statute also provided that the court may pass an order to secure the persons interested from danger or loss from the breaking of the dam. Defendants owned an old wooden, trench dam which held back the waters of a pond. Defendants wished to demolish the dam since it was no longer being used. Upon removal of a few of the upper planks, the pond level dropped, and mudflats were exposed. Property owners complained of pollution and mosquitoes, whereupon, the Chief of Harbors and Rivers ordered defendants to submit professional plans before continuing with any alteration. Defendants refused to comply with this order, and the Attorney General filed a petition asking that defendants be ordered to comply with the Chief's order to prevent injury to life or property from the unsafe condition of the dam. The lower court granted the order, but the appellate court reversed. The court held the purpose of the statute was only to protect against dangers due to a dam breaking and excess water. The court also held that the owners of a dam are under no legal obligation to keep it in operation for the benefit of others. (Wheeler-Fla)
W69-03897

FOCAL MECHANISM OF THE EARTHQUAKE OF JULY 26, 1963, AT SKOPJE,
Ye I Shirokova.
Phys Solid Earth, No 2, pp 104-109, Feb 1968. 6 p, 8 fig, 2 tab, 8 ref.

Descriptors: *Earthquakes, *Seismology, Seismic waves, Longitudinal waves, *Faults (Geology), Geophysics, Geologic investigations, Stress analysis, Displacements, Seismic investigations, Seismic studies.
Identifiers: Epicenters, *Earthquake focus, Skopje (Yugoslavia), Yugoslavia, Earthquake theory.

The focal mechanisms of the earthquake that destroyed the city of Skopje, Yugoslavia, in July 1963 is discussed. The focal depth was approximately 3 to 5 km. In the interpretation of seismograms of the Skopje earthquake, the focus was compared with a theoretical earthquake source in the form of an instantaneous fault with displacements in the fault plane. By observing the distribution of actual body wave displacements and comparing them with displacements calculated for the theoretical source (depths of zero, 10, and 30 km) it was possible to determine the possible fault planes, the direction of motion in these planes, and the direction of the principal stress axes. Records from 46 seismograph stations were used in the analysis. Conclusions from the study were: (1) the earthquake occurred under conditions of horizontally acting tensile stress in the meridian direction, (2) the fault occurred along a plane striking WNW and dipping from 55 to 80 deg to the NNE, and (3) Skopje is located on the hanging wall of the fault which was displaced downward and to the WNW.
W69-04009

WATER PROBLEMS IN THE NORTHEAST AND INCREASING FEDERAL REGULATION,
For primary bibliographic entry see Field 06E.
For abstract, see .
W69-04052

8B. Hydraulics

ANALYSIS OF AQUIFER TESTS IN THE PUNJAB REGION OF WEST PAKISTAN,
Geological Survey, Washington, D. C.
For primary bibliographic entry see Field 02F.
For abstract, see .
W69-03975

8C. Hydraulic Machinery

REDUCING CAVITATION IN VALVES,
Colorado State Univ., Fort Collins.
J. Paul Tullis, and M. M. Skinner.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 94, No HY6, pp 1475-1488, Nov 1968. 14 p, 8 fig, 9 ref, append.

Descriptors: *Butterfly valves, *Cavitation, High pressure valves, *Hydraulic valves, *Valves, Test procedures, Steady flow, Vortices, Closed conduit flow, *Closed conduits, Air, Compressed air, Hydraulic equipment, Instrumentation, Costs, Maintenance costs, Injection, *Hydraulic gates and valves.
Identifiers: *Cavitation control, Cavitation index, *Cavitation noise, Test results.

Critical cavitation indices are presented for a 12-in. ball and a 12-in. butterfly valve installed in a closed conduit with an enlarged section downstream. Tests were conducted under normal operating conditions and with air (atmospheric and pressurized) and water being injected to control cavitation. Injecting a small amount of air into the low pressure region is a very satisfactory method of controlling cavitation, whereas using water is not. The most critical factor in successfully using air is so placing the injection port that it admits air as close as practicable to the high intensity shear region between the jet and the separation zone. If the port is properly placed, atmospheric air is satisfactory for reducing cavitation. For valves where it is neither possible nor practical to locate the injection port in the optimum location, pressurized air can be used effectively to reduce cavitation. (USBR)
W69-03757

PROTOTYPE INVESTIGATIONS OF DYNAMICS OF A TRIPLE-RIB OF A PLANE GATE OF THE DAM OF THE XXII CONGRESS CPSU VOLGA HES,
M. A. Rudyk, A. R. Freishist, and A. A. Davydov.

Hydrotech Constr, No 2, pp 134-140, Feb 1968. 7 p, 9 fig, 14 ref.

Descriptors: *Hydraulic gates, *Vibrations, Frequency, Investigations, *Spillway gates, Instrumentation, Foreign research, Waves (Water), Gates, Tensiometers, Mechanical engineering, Design, Experimental data, Deformation, Characteristics, *Hydraulic gates and valves.
Identifiers: USSR, Amplitude.

This study reports on a theoretical method of determining dynamic characteristics of ribbed gates and how they are affected by water masses, and on the investigation of the reaction of a vibrating gate system to different dynamic disturbances such as vibration of piers, aero- and hydrodynamic impulses, and wave loads. The experimental work consisted of 2 stages: (1) investigating free vibrations of a gate in water and in air and determining its dynamic characteristics, and (2) investigating the vibration of a gate under a head with different gate openings. Instrumentation is discussed. Results of the study show that a reverse relation exists between the pulsations of pressure and the pulsations of gate ribs, and that the system of a gate exhibits a tendency toward hydroelastic autovibration processes of natural frequency when in water. Determining inherent vibration characteristics of a gate is very important in gate design. (USBR)
W69-03765

THE PLANNING, CONSTRUCTION AND OPERATION OF POWER STATIONS IN LARGE INTERCONNECTED SYSTEMS--THE STRATEGY OF LARGE-AREA POWER SUPPLY,
Federal Power Station Dept. (West Germany).
K. Schroder, and E. Brunecke.
Pap, World Power Conf, Aug 1968. 28 p, 4 fig.

Descriptors: *Electric power, *Electric power production, Reliability, Electric power demand, Electric power costs, *Thermal powerplants, Cost comparisons, Planning, Economics, Peak loads, Forecasting, Steam turbines, Foreign research, Design, Boilers, Coals, Transmission (Electrical), Failure (Power).
Identifiers: *Interconnected systems, West Germany, Fossil fuels, Base loads, Outages.

The electric power load growth studies of the Federal Republic of Germany through 1980 are presented. The interconnection of power supply systems to continental and intercontinental systems on the scale that can be expected in the future will create the need for new approaches in planning, designing, and constructing thermal power stations. The design of individual plants can be selected more specifically for a certain fuel and mode of operation. Internal reserve capacity can be reduced. These measures all contribute to reducing specific first costs. It is also important to keep kwh costs at the consumer end as low as possible by skillful combination of the power sources. Subjects discussed include: (1) basic concepts, (2) future problems in power generation, (3) modern power station technology, and (4) considerations necessary for the best design in power stations.
W69-03771

UNITED STATES DEVELOPMENTS IN UNDERGROUND TRANSMISSION,
Boston Edison Co., Mass.
Charles F. Avila.
Pap, World Power Conf, Aug 1968. 17 p, 7 fig, 1 tab.

Descriptors: *Electric cables, *Transmission (Electrical), Costs, United States, Economies, Installation, Installation costs, Moisture, Inert gases, Contamination, Extra high voltage, Dielectrics, Heat exchangers, Underground.
Identifiers: *Underground cables, Buried cables, *Pipe-type cables, *Forced-cooling systems, Oil-filled cables, Insulating oil.

Progress in underground cable technology in the U S has been steady since the introduction of pressurized cable in 1926. Cable has been employed mainly to carry substantial blocks of power under heavy-duty pavements of congested streets in large cities. These sites favor installation of a drawn-in system rather than a direct buried system. In addition, the high cost of labor increases splicing expense, thus favoring the installation of very long lengths. Evolution of new cable systems and modification of existing systems to meet these con-

ditions are traced. Developments in pulling long lengths of cable and in substantial use of forced cooling methods are emphasized. Factory techniques resulting in satisfactory manufacture of commercial lengths of cable are described. The status of current research programs in the fields of extra high voltage, extruded dielectrics, joint simplification, synthetic insulation, and environmental control is summarized.
W69-03773

PROJECTED TRENDS AND REQUIREMENTS IN THE COORDINATED GROWTH OF ELECTRIC POWER SYSTEMS IN THE UNITED STATES,
Federal Power Commission, Washington, D. C.
F. Stewart Brown, and Robert B. Boyd.
Pap, World Power Conf, Aug 1968. 18 p, 2 fig, 2 ref.

Descriptors: Extra high voltage, Extra long distance, *Electric power production, Planning, *Electric power demand, Hydroelectric power, Thermal power, Stability, Reliability, Failure (Power), Coordination, Automation, Disturbances, *Electrical networks, Transmission (Electrical).
Identifiers: *Interconnected systems, Spinning reserve, *Power grids, Outages, Power losses.

This paper examines trends in coordination and interconnection of electric power systems in the U S, and reviews principal recommendations of the Federal Power Commission in its report on the 'Prevention of Power Failures.' A steady increase in interconnection of power systems has added to the general reliability of electric service and has contributed to more economical construction and operation of interconnected networks. Many severe cascading failures have occurred; the best solution to such problems requires coordination of planning on a regional basis and the design, construction, and operation of facilities that meet requirements of reliability and economy. Rapid growth in use of electricity in the U S, in combination with diverse characteristics and conditions affecting electric utility operation, offers opportunities for using technological advances and new equipment affording improved reliability and economy. Criteria for testing transmission network designs are discussed, the need for reliable interconnection of networks is emphasized, and an increase in research effort is suggested. Progress in reducing power failures is recognized, and areas of interest concerning reliability are discussed.
W69-03774

ROLE OF HIGHER VOLTAGE TRANSMISSION IN CHANGING ASPECTS OF ENERGY TRANSPORT,
Commonwealth Associates, Inc., Jackson, Mich.
O. B. Falls, Jr.
Pap, World Power Conf, Aug 1968. 23 p, 2 fig, 3 tab, 9 ref.

Descriptors: Electric power, *Transmission (Electrical), *Energy, Oil, *Transportation, *Forecasting, Extra high voltage, Direct current, Cost comparisons, Alternating current, Economics, Hydroelectric power, Extra long distance, Transmission lines, Converters (Electrical), Rectifiers, Coals, Railroads, Pipelines, Natural gas, Air pollution, Costs.
Identifiers: Interconnected systems, Fossil fuels.

The author describes rapid advances taking place in the field of high-voltage power transmission in the U S and notes that electric power transmission is an increasingly important mode of energy transport. Typical costs are presented for: (1) 345-, 500-, and 750-kv a-c power transmission; (2) 750-kv d-c power transmission; and (3) fuel transport by railway, barge, and pipeline. Conclusions and forecasts of the future role of these methods of energy transport are offered. The introduction and growing commercial application of high-voltage direct current for long-distance transmission will cause significant changes in the field of energy transport. More remote hydroelectric developments will be brought within reach and more widespread load areas will be interconnected to exploit diversity of area energy demands, all leading to changing patterns of fuel consumption. Historical data and current factors at work in the electrical transmission field suggest that the very-high-voltage systems of tomorrow may be more economically attractive. Growing worldwide concern with environmental concepts is one of the most important factors now influencing decisions in energy transport.
W69-03775

ECONOMIC AND DESIGN CONSIDERATIONS OF THE PACIFIC NORTHWEST-PACIFIC SOUTHWEST INTERTIE,
Bureau of Reclamation, Washington, D. C.
Floyd E. Dominy.
Pap, World Power Conf, Aug 1968. 2 p, 1 fig, 2 ref.

Descriptors: *Extra high voltage, *Extra long distance, Benefits, Benefit-cost ratios, Peak power, Hydroelectric power, Thermal power, Energy, Economics, Direct current, Alternating current, Design, *Transmission lines, Transmission (Electrical), Corrosion, Stability, Converters (Electrical).
Identifiers: *Pacific Northwest-Southwest Intertie, Firm energy, *Interties, International river basin, Ground return.

The Pacific Northwest-Southwest Intertie, the largest single electrical transmission development undertaken in the U S, is described. The intertie will interconnect (directly or indirectly) major systems of the Federal Government and public and private electrical systems in 11 western states, promoting maximum electrical efficiency and benefits throughout these states. Two intertie transmission lines will be d-c lines, the first in the U S and the longest in the world. Benefits to the Pacific Northwest and Pacific Southwest areas of the U S and to the Nation as a whole will be extensive. Over a 50-yr payout period, total benefits are estimated at $2.6 billion, having a benefit-cost ratio of 2.5:1. These benefits and other economic considerations are discussed. Because the intertie represents major advances in the technology of electrical transmission, some major facets of design being considered in developing the intertie facilities are discussed.
W69-03776

MEASUREMENT OF TRANSFORMER NOISE AND ITS REDUCTION,
English Electric Power Transformers Ltd, Stafford.
G. D. Antippa.
Engl Elec J, Vol 23, No 4, pp 21-27, July-Aug 1968. 7 p, 13 fig, 8 ref.

Descriptors: *Power transformers, *Noise, *Noise reduction, Sound, Instrumentation, Microphones, Standards, Acoustics, Foreign research, Acoustic insulation, Vibrations, Design, Magnetic fields, Electrical equipment.
Identifiers: Great Britain, Foreign testing, Anechoic chambers.

The study of transformer noise over the past 10 yr has developed techniques for handling any reasonable problem. Measurements can be taken and specifications or criteria can be met. The economics of suppressing noise have not been dealt with in this paper, but considering the problem of noise at the design stage is better than waiting until complaints arrive. Techniques used to measure and control transformer noise levels to within specified limits are described. Methods used for reducing noise from transformers include: (1) barrier walls; (2) an enclosure of brick, steel, or concrete; (3) cladding of steel, lead, or lead-weighted plastics; and (4) foam lining for transformer tanks. Each of these methods is reviewed. (USBR)
W69-03790

THE ADVANTAGES OF INCLINED-AXIS HYDROELECTRIC UNITS,
Corps of Engineers, Washington, D. C.
Asa V. Shannon, and C. H. Fogg.
Pap, World Power Conf, Aug 1968. 25 p, 2 fig.

Descriptors: *Axial flow turbines, *Hydraulic turbines, Planning, Cost comparisons, Bulb turbines, Feasibility studies, Efficiencies, Thrust bearings, Hydroelectric power, Economics, Model tests, Pump turbines, Investigations.
Identifiers: *Run-of-the-river powerplant, Corps of Engineers, Low head, *Low-head hydro plants, *Inclined-axis units.

Decision processes of the Corps of Engineers in a pioneer effort in hydroelectric development are described. Details of the studies and investigations leading to the selection of inclined-axis units (in the 20,000- to 30,000-kw range) for 3 projects in the low head category are included. The inclined-axis arrangement is not without precedent. Turbine runners of 8.0-m dia are no longer unusual. Generators of the size and speed required are practically standard design. Speed changers of the capacity and efficiency needed for 2 of the projects have long been available as shipboard equipment. The pioneering consisted of acting on the belief that these components in large sizes could be adapted into an efficient whole suitable for generation (or generation and pumping). The structure for these units was estimated to cost substantially less than the structure required for conventional vertical generating units of like capacity. Equipment and other costs have corresponded well with estimated costs. Installations at 4 projects are discussed. (USBR)
W69-04010

8D. Soil Mechanics

DAMS AND RESERVOIRS IN PLEISTOCENE-EOLIAN DEPOSIT TERRANE OF NEBRASKA AND KANSAS,
Bureau of Reclamation, Denver, Colo.
William I. Gardner.
Pap, Symp Reservoir Leakage Ground Water Contr, Ass Eng Geol Nat Meet, Seattle, Wash, 1968. 23 p, 5 fig, 1 tab, 8 ref.

Descriptors: *Loess, *Dam foundations, Earth dams, Reservoirs, *Seepage losses, Dune sands, *Reservoir leakage, Granular materials, Sands, Cutoff trenches, Cutoffs, Impervious materials, Drainage wells, Settlement, Geology, Geologic formations, Pleistocene epoch, Aeolian soils, Engineering geology, Alluvial deposits.
Identifiers: Seepage control.

The general geologic situation is discussed and the leakage and foundation problems are considered at a few Bureau of Reclamation dams and reservoirs. The reservoir sites are located in Pleistocene-eolian deposits in central and western Neb and Kans and northeastern Colo. Initial pessimism on the feasibility of conservation reservoirs in permeable continental sediments of the loess and sand dune region has changed to cautious optimism through knowledge gained from construction and successful operation of many reservoirs. Loess and dune sands are moderately permeable but do not present major leakage problems. Seepage occurs mainly through Pleistocene alluvial sands and gravels and through zones of uncemented sandy beds in the Ogallala formation. Treatment confined to the area of the dam and adjacent parts of abutments and channel has been sufficient to control losses to acceptable amounts. Cutoffs and blankets of impermeable material from required excavation have been used successfully to reduce seepage. Thorough drainage at the toe of the dam is necessary; additional drainage by ditches or relief wells is needed after the reservoir starts filling when requirements can be properly determined. Seepage losses have not impaired the planned operation of the projects. (USBR)
W69-03762

DESIGN OF A SPILLWAY DAM ON SHELL PILES AND METHOD OF STATIC CALCULATION OF ITS FOUNDATION,
A. R. Berezinskii, and D. F. Gerstle.

Hydrotech Constr, No 2, pp 119-126, Feb 1968. 8 p, 4 fig, 1 tab, 2 ref.

Descriptors: *Spillways, *Pile foundations, Pile lateral loads, Piers, Foreign design practices, Dam design, Dam foundations, Bending, *Foundations, Hydraulic structures, Sheet piling, Batter piles, Bending moments, Elastic deformation.
Identifiers: Spillway piers, USSR, Dam stability, Pile caps.

This article describes the design and method of static calculation of the foundation of a medium-head spillway dam constructed on shell piles in a nonrock base. The upstream face of the dam consists of shell sheet piling and is rigidly joined with the spillway slab. Sheet piling is not directly connected with pier foundations. Load is transmitted to piers through spillway slab projections that pass freely into grooves on the piers. This design permits the assumption that the sheet piling undergoes plane bending which protects the lock joints. Pier foundations are tall grillages composed of separately standing vertical and batter shell piles, permitting a fuller utilization of the foundation-bearing capacity. A pile is regarded as a bar obeying the laws of the theory of strength of materials and undergoes bending with its lower part embedded in assumed elastic soil. The static calculation of the dam foundation can be reduced to a plane problem with forces collected within one span. The sequence used to analyze the pile foundation is illustrated by a sample problem. (USBR)
W69-03766

GROUTING OF THE LIMESTONE FOUNDATION FOR THE ARSTADDALEN DAM,
L. Bjerrum, and I. Torblaa.
Norw Geotech Inst, Publ 80, pp 33-38, 1968. 6 p, 5 fig.

Descriptors: *Grout curtains, *Grouting, *Dam foundations, Earth dams, Geology, Foundations, Foundation rocks, *Rockfill dams, Cores, Filters, Foreign construction, Geologic formations, Limestones, Rock properties, Bentonite, Permeability.
Identifiers: Grouting pressure, Grout mixes, Grout take, *Arstaddalen Dam, Norway, Seepage control, Geologic defects, Impervious layers.

The engineering-geological features of the foundation for the 60-m-high earth and rockfill Arstaddalen Dam are described, with emphasis on rock permeability and grouting to reduce leakage. The dam has an impervious core protected with filters on both sides. The outer zones are constructed of rockfill to a slope of 1.7:1. The foundation rock was a limestone with relatively serious defects due to solubility. Rock permeability ranged from 0.05 to 0.5 ft per yr. The area took part in the Caledonion upheaval, subjecting it to severe folding and intrusion of various eruptives. Under the influence of folding pressures and high temperatures from intrusions, the limestone has locally recrystallized and transformed into marble. The grout curtain consisted of 2 rows of holes bored to at least 20 m or until the water loss was less than one Lugeon. The grout used was a mixture of cement and water with an admixture of 2% bentonite by weight. In addition to curtain grouting, blanket grouting was carried out over the total area where the core was to be in contact with the rock. Blanket grouting was performed from a series of 6.4 m deep borings made by percussion drilling. Cost of the grouting work represented about 6% of the total cost of the dam. (USBR)
W69-03777

GENERAL PROCEDURE IN INVESTIGATION, DESIGN AND CONTROL DURING CONSTRUCTION OF EARTH- AND ROCK FILL DAMS IN NORWAY,
B. Kjaernsli.
Norw Geotech Inst, Publ 80, pp 1-20, 1968. 20 p, 24 fig, 2 tab, 22 ref.

Descriptors: *Dam design, *Earth dams, *Rockfill dams, *Foreign design practices, Engineering geology, Field investigations, Dam construction, Aerial photography, Geologic investigations, Laboratory tests, Climatic data, Dam foundations, Embankments, Foreign construction, Borrow areas, Seepage, Soil properties, Specifications, Grouting, Bibliographies.
Identifiers: Norway, Construction control.

The general procedure followed at the Norwegian Geotechnical Institute in consulting activities concerning earth and rockfill dams in Norway is described. Norway has been covered by ice 3 times and, as a result, the country is 60% covered by moraines. Geologic and climatic conditions are discussed and illustrated by figures. Because of the topography and storage requirements, maximum height of existing earth and rockfill dams is approximately 90 m. Blasted rock, gravel, and morainic materials are commonly used in embankments. Laboratory investigations are usually limited to testing core and filter material. Soil properties used in stability calculations are determined from laboratory tests, but properties of gravel and rockfill are usually assumed. Generally, the dam axis is curved upstream and very steep abutments are avoided, even at the cost of increased volume. The steepest abutment used has been 1:1. Cross sections and descriptions of 23 dams built in Norway in the last decade are given. Specifications are based on the method of construction and on specific end results desired. A table is given of data on foundation grouting for several Norwegian dams. (USBR)
W69-03778

GENERAL SLOPE STABILITY ANALYSIS,
Colorado State Univ., Fort Collins.
James M. Bell.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 94, No SM6, pp 1253-1270, Nov 1968. 18 p, 12 fig, 1 tab, 5 ref, 3 append.

Descriptors: *Stability analysis, *Slope stability, Safety factors, Sliding, Slip-circle method, Slipping, Seismic investigations, Numerical method, Stress distribution, Cohesion, Pore pressure, Soil mechanics, Effective stress, Computer programs, Earth dams, Embankments, Slopes.
Identifiers: Seismic stability, *Computer-aided design, Earthquake loads, Failure surfaces, Bishops method, Slip surface.

A statically accurate limiting equilibrium procedure was developed for the numerical treatment of slope stability problems. The method: (1) applies to homogeneous or nonhomogeneous earth slopes, (2) contains a wide variety of loads and approximately accounts for the influence of seismic effects through inclusion of statically equivalent horizontal and vertical earthquake forces, (3) requires a normal stress distribution assumption, and (4) can be carried out either in terms of effective stress with input of effective strength parameters and excess pore pressures, or in terms of total stress with input of appropriate shearing resistances (phi - 0). A sample problem illustrates the application of the new procedure for a nonhomogeneous slope with a wide range of loads. Rapid convergence of solutions was noted for a specific normal stress distribution assumption; the stresses obtained seem appropriate. Results are compared with results obtained from other methods. Assuming the availability of a high-speed computer, the engineer is provided an additional tool for estimating the stability of complex earth slopes. (USBR)
W69-03779

CONSTRUCTION PROBLEMS EXPERIENCED WITH LOESS SOILS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
W. J. Turnbull.
Highw Res Rec, No 212, pp 10-27, 1968. 18 p, 33 fig, 17 ref.

Descriptors: *Loess, *Cut slopes, Seepage, Gullying, Sinkholes, *Land settlement, Cavities, Soil compaction, Bibliographies, Construction, Density, Soil liquefaction, Shear strength, *Soil structure, Soil properties, Settlement, Stratification.
Identifiers: Construction methods, Piping (Erosion).

Loess deposits cover 17% of the land surface of the United States. This paper is based on the author's experiences with these soils in various types of construction, particularly in Miss and Neb. Until construction of the Central Nebraska Public Power and Irrigation Project along the North Platte River, many engineers doubted the feasibility of using loess as a construction or foundation material. The internal structure and stratification of loess and the cut slope problem are discussed and illustrated by figures. Deep cut, soil bank, and settlement problems are also reviewed. The project demonstrated that loess soils could be used safely as a construction material or as a foundation for earth dams and hydraulic structures. Compacting the loess soil to wet of optimum is the reason that all structures withstood settlement. Satisfactory behavior of steep cut bank slopes along a major project canal for 30 yr is evidence that steep backslopes should be used in loess soils. (USBR)
W69-03803

LATERAL PRESSURE OF EARTH BACKFILL,
V. Kh. Gol'tsman.
Hydrotech Constr, No 8, pp 738-742, Aug 1967. 5 p, 1 fig, 3 ref.

Descriptors: *Backfill, *Lateral forces, *Retaining walls, *Earth pressure, Displacements, Granular materials, Structures, Cohesion, Soil mechanics, Internal friction, Active pressures, Passive pressures, Horizontal loads, Elastic deformation.
Identifiers: Coulomb theory, Soil-structure interaction, At rest pressure.

Background theory and equations necessary to calculate lateral pressure of earth backfill are presented. Applying various theories for determining lateral pressure of earth backfill on retaining walls is difficult because of the necessity to reconcile discrepancies between these theories. Lateral earth pressure differs from hydrostatic pressure because of frictional and cohesive forces in the soil. These forces reduce pressure if the wall deflects away from the backfill and increases the pressure if the wall reclines on the backfill. The limiting-equilibrium theory (based on Coulomb's theory) permits determining the lower and upper limits of lateral earth pressure, irrespective of soil deformation, structural displacements, or state of the backfill. Coulomb's theory for granular materials holds true (from a practical viewpoint), and provides the extreme values of lateral earth pressure on vertical or steeply inclined rear faces of structures. Forces and moments acting on a structure are given in 8 equations. (USBR)
W69-03805

8E. Rock Mechanics AND Geology

SEISMIC RESONANCE INVESTIGATION OF A NEAR-SURFACE CAVITY IN ANCHOR RESERVOIR, WYOMING,
Geological Survey, Flagstaff, Ariz; and North Carolina Univ., Chapel Hill.
Richard H. Godson, and Joel S. Watkins.
Bull Ass Eng Geol, Vol 5, No 1, pp 27-36, 1968. 10 p, 5 fig, 2 plate, 4 ref.

Descriptors: *Cavities, *Engineering geology, *Geophysics, *Resonance, *Reservoir leakage, Sinks, Reservoirs, Reservoir surveys, Oscillation, *Seismic investigations, Seismic waves, Seismographs, Bedrock, Geologic investigations, Subsurface investigations, Frequency, Sinkholes.
Identifiers: Anchor Dam (Wyo), *Cavernous rock, Geophysical prospecting, *Resonance frequency method, *Seismic prospecting.

A small part of the Anchor Reservoir area was investigated by a seismic resonance method for locating near-surface cavities that could develop into surface sinks. The seismic resonance method consists of exciting resonant vibrations in cavities by nearby dynamite explosions and recording these vibrations (at the surface above the cavities) by a wide-band seismograph system. Initial ground motion generated by an explosion in rock is attenuated rapidly and may be reduced 90% about one-half second after the explosion. Cavity vibrations persist much longer and have been observed for as long as 4 seconds after the explosion. This resonance exhibits a dominant time-independent frequency distinguishable from other types of seismic energy. The size of the cavity and seismic wave velocity in surrounding rock determines the resonant frequency. The exact relationship between cavity size and resonant frequency is not known, but estimates of cavity size can be made within a factor of 3 of actual cavity diameters. Results of the seismic resonance field investigations at Anchor Reservoir are discussed and compared with a previous gravity survey in that area. (USBR)
W69-03759

'BLOCKY AND SEAMY ROCK' IN TUNNELING,
Norges Tekniske Hoegskole, Trondheim.
Tor L. Brekke.
Bull Ass Eng Geol, Vol 5, No 1, pp 23-26, 1968. 4 p, 4 ref.

Descriptors: *Rock mechanics, *Tunnel design, Tunnels, Roof supports, Underground structures, *Discontinuities, Joints (Geology), Engineering geology, Rock properties, *Tunnel pressures, Tunneling, Groundwater, Foreign research, Hydrostatic pressure, Shear strength.
Identifiers: *Tunnel supports, *Subsurface openings, *Arching, Norway, Rock competency, *Rock pressures.

Basic concepts are evaluated for Terzaghi's classification of rock conditions and estimation of rock loads for blocky and seamy rock. The basis for Terzaghi's estimation of rock loads is the assumption that blocky and seamy rock essentially has the character of a dense sand with very large grains and no cohesion. However, the contact area between rock blocks is much larger than the contact area between sand grains, and the shear strength of joints and seams can be mobilized over virtually the entire area of the discontinuities. Downward movement of rock-block layers in the immediate roof above a tunnel may mobilize horizontal thrust throughout the layers, yielding stable downward arches of blocks that carry only their own weight. Investigations of more than 250 underground works in Norway show the quite surprising stability of blocky and seamy rock in tunnels situated well below the water table, and directly contradicts rock-load estimates based on the sand analogy. Support requirements in blocky and seamy rock based on the sand analogy often result in rather conservative design (particularly in tunnels well below the ground-water table) except in areas with high inflow conditions. (USBR)
W69-03760

ANALYSIS OF WEDGE FAILURES IN LAYERED ROCKS,
University of Southern California, Los Angeles.
Bernard W. Pipkin.
Bull Ass Eng Geol, Vol 5, No 1, pp 12-17, 1968. 6 p, 3 fig, 2 ref.

Descriptors: *Slope stability, Landslides, Stability analysis, *Rock mechanics, *Engineering geology, Beds (Geology), Structural geology, Dips, Slopes, Cuts, Slipping, Sliding, *Cut slopes, Rocks, Wedges, Geometry, Retaining walls.
Identifiers: Slip planes, Strikes (Geology), *Rock slope stability, Geologic defects.

A geometric analysis is made of the stability of layered rock oriented at an angle to the strike of an artificial or natural slope. Slopes oriented in this manner show an apparent dip of the layered rock that is always less than the true rock dip. Slope failure in this situation involves the translation of a small rock wedge directly down dip and is called a wedge failure. Using apparent dip as a design parameter for retaining structures or slope stability analysis has no prior justification and may lead to unnecessary additional lateral slope support. The analysis assumes rock in good condition, relatively free from defects that might control sliding, and does not presume the failure of unsupported wedges determined by shear resistance along potential failure planes. Nomographs are given for determining the minimum setback for locating structures beyond the zone of wedge failure parallel to the top of cut slopes. (USBR)
W69-03761

STRENGTH AND EARTH PRESSURE OF ROCK WITH WEAK PLANES,
Tokai Univ., Tokyo (Japan).
Shigeyasu Okusa.
Soils Found, Vol 8, No 1, pp 49-79, Mar 1968. 31 p, 22 fig, 13 ref.

Descriptors: *Rock mechanics, Rock properties, *Shear strength, Rocks, Discontinuities, Joints (Geology), Foreign research, Shear failures, Failure (Mechanics), *Earth pressure, Stress analysis, Sliding, Active pressures, Passive pressures.
Identifiers: Japan, *Rankine pressures, Coulomb-Navier model, Rock slope stability, *Weakness planes, Failure surfaces, Rock pressures.

Two- and 3-dimensional analyses were made of the strength and Rankine earth pressure of rocks containing weak planes with a vertical slope. Two questions in considering shear strength of rock with weak planes are: (1) whether failure occurs along the weak planes or in the solid rock cutting the weak planes; and (2) the stress conditions for failure to occur along the weak planes. The 2-dimensional conditions for failure in the weak plane are discussed. The stable height of a vertical slope is derived from an analysis of earth pressures related to the direction of weak planes. Shear strength analyses are based on the Coulomb-Navier theory. Rock fails along weak planes before a new fracture cuts the planes if the angle between the planes and the principal stress lies within a determinable range. Active earth pressures are greater and passive earth pressures are less for rock with weak planes, compared with intact rock. The 3-dimensional problem of rock with weak planes is analyzed; failure occurs along weak planes if direction cosines of the normal to the planes with principal axes lie within a specified range. In this case, the medium principal stress plays an important role in failure along weak planes and in determining the dangerous range of direction cosines. (USBR)
W69-03768

STABILITY OF ROCK SLOPES IN NORWAY,
Laurits Bjerrum, and Finn A. Jorstad.
Norw Geotech Inst, Publ 79, pp 1-11, 1968. 11 p, 18 fig, 15 ref.

Descriptors: *Rock mechanics, Rock properties, Rocks, *Rockslides, *Landslides, *Engineering geology, Geologic investigations, Equilibrium, Foreign research, Granites, Gneisses, Slope stability, Slopes, Stability analysis, Field investigations, Joints (Geology), Bibliographies.
Identifiers: *Rockfalls, *Rock slope stability, Norway, Slope angles.

The Norwegian Geotechnical Institute has surveyed some 300 unstable areas, and other areas where rockfalls and rockslides have occurred, to study the factors determining stability of rock slopes. Experiences gained through the study are described. The behavior or rock slopes is attributed to 3 factors: (1) the way the mountain slope is exposed to rock destruction, (2) the elapsed time before a slope reaches a final stable equilibrium, and (3) the angle of inclination the slope will assume at a stable condition. Experiences clearly show that stability problems in hard Norwegian rocks cannot be solved by theoretical methods. The stability is entirely dependent upon the extent and continuity of joint systems, presence of internal residual stresses, local stress concentrations, fatigue failures, and many other indeterminate factors incapable of treatment in a conventional stability analysis. An empirical method for solving slope stability problems has been developed, based on field observation of all physical processes and significant phenomena. Although the method has not been fully developed, it is the only practical method for solving the complex problems of slope stability in hard unweathered rock.
W69-03782

THE DENVER EARTHQUAKES,
Geological Survey, Menlo Park, Calif; Institute of Geophysics and Planetary Physics, University of California, Los Angeles.
J. H. Healy, W. W. Rubey, and D. T. Griggs.
Sci, Vol 161, No 3848, pp 1301-1310, Sept 1968. 10 p, 9 fig, 2 tab, 29 ref.

Descriptors: *Earthquakes, *Seismology, Seismic waves, Geophysics, *Waste disposal, Seismic investigations, Seismic properties, Pore water pressures, Seismic studies, *Injection wells, Geologic investigations, Geology, Stress analysis, Faults (Geology), Bibliographies.
Identifiers: Epicenters, Correlation, Fluid injection, Earthquake theory, Earthquake focus, Denver, (Colo), Earthquake forecasting.

In 1961, a disposal well was completed for the U S Army at the Rocky Mountain Arsenal north of Denver, Colo, for disposing of waste fluids from chemical manufacturing operations. The well was 3,671 m deep and bottomed in Precambrian crystalline rock. Injection of fluids began in Mar 1962 and continued through Sept 1962 at an average rate of about 5.5 million gal/mo. No fluid was injected from Oct 1963 to Aug 1964. Fluid was later put into the well by gravity flow and, subsequently, put under pressure until use of the well was stopped in Feb 1966 because of the suggested connection between the well and earthquakes in the area. The article discusses the program to determine whether there was a connection between the operations of the disposal well and the earthquakes. The mechanism of the earthquakes is discussed. Most investigators working on the problem have concluded that injecting fluids into the disposal well triggered the seismic activity. (USBR)
W69-03802

LOCATION OF THE SOURCES OF SEISMOACOUSTIC PULSES,
Ya Ya Kagan.
Phys Solid Earth, No 5, pp 321-325, May 1968. 5 p, 6 fig, 7 ref.

Descriptors: Coal mines, Foreign research, *Mining engineering, *Rock mechanics, Mining, Seismic waves, Rock properties, *Engineering geology, Geologic investigations, Geophones, Seismographs, Longitudinal waves, Geophysics, *Seismic investigations, Seismic properties, Tunneling, Acoustic equipment.
Identifiers: Foreign testing, *Rock noise, *Microseisms, Rockbursts, Seismic tests, Seismic sources, USSR, Rock breakage, Rock pressures.

Seismoacoustic methods have shown that the stressed state of a rock mass is characterized by the number of seismoacoustic pulses occurring in a given period of time. Multichannel recorders were used to obtain a fuller picture of the rock destruction process and the location of the pulse sources. The object of the investigation was to improve seismoacoustic forecasting of the risk of dynamic phenomena in mining coal seams in the Donets Basin. By locating pulse sources, the observed noise level can be related to a specific zone ahead of the longwall face and thus determine the ad-

vance that will bring the face into the danger area. The equipment and operating procedures are described. Results from an investigation of pulse source distribution are discussed. (USBR)
W69-04008

8F. Concrete

CONDITION OF JOINTS IN MASSIVE CONCRETE STRUCTURES DETERMINED BY ULTRASONICS,
G. Ya. Pochtovik, A. S. Nikol'skii, and A. V. Mizonov.
Hydrotech Constr, No 3, pp 228-232, Mar 1968. 5 p, 6 fig.

Descriptors: *Construction joints, Concrete construction, Rupturing, *Concrete structures, *Concrete testing, Cracks, Ultrasonics, *Expansion joints, Sonic waves, Test procedures, Mass concrete, Materials testing, Instrumentation.
Identifiers: Concrete properties, Pulse velocity tests, USSR, Foreign testing, *Ultrasonic impulse method, *Ultrasonic tests.

Construction joints in concrete are planes of weakness that determine and control the deformation of the concrete structure. The ultrasonic pulse method for investigating the adjustment and condition of interior construction joints is described. Ultrasonic transmitter-receivers are embedded 10-15 cm from construction joints during concrete placing. Ultrasonic measurements are made at intervals as the concrete cures until the readings show that the joint has stabilized. Control readings are taken over a period of 15-20 days to establish a characteristic ultrasonic traveltime for the joint. Further readings are made during the construction period and at later ages to determine if the joint is still intact. As tension develops and the joint ruptures, the characteristic traveltime increases; the increase is more significant when rupture is accompanied by separation and formation of an air space. When the continuity of the concrete is broken between the transmitter and receiver, the resultant change in the ultrasonic wave may be used to detect cracks. Laboratory tests are described for joints under tension and compression and with artificial opening and closing of joints. (USBR)
W69-03799

FROST DAMAGE TO STONE AND CONCRETE: GEOLOGICAL CONSIDERATIONS,
Notre Dame Univ., Ind.
Erhard M. Winkler.
Eng Geol Int J, Vol 2, No 5, pp 315-323, Aug 1968. 9 p, 5 fig, 1 tab, 14 ref.

Descriptors: *Freezing, *Frost action, Frozen soils, Permafrost, Ice, Capillarity, Capillary tubes, Frost heaving, Frozen ground, Durability, Phase diagrams, Capillary water, Concretes, Rocks, Soils, Engineering geology, Porosity, Piles (Foundations), Geologic investigations, Concrete technology.
Identifiers: *Freeze-thaw durability, *Frost resistance, Ice forming, Ice lenses.

Frost damage to stone and concrete is due to expansion during freezing of water. Frost action depends not only on the expansion of ice but also on other phenomena including: (1) the process of freezing as related to the pvt diagram for ice, (2) the movement of water to the freezing zone and behavior in microcapillaria, and (3) lithologies that promote frost action. Engineering geological applications of the pvt ice diagram are: (1) the frost stability of stone if strength, climate, and capillary size are shown; (2) stability of point-bearing piles in muddy frozen sediments; and (3) geological thermometry applications in the study of felsenmeers. Frost sensitivity of soils is discussed. (USBR)
W69-03804

8G. Materials

THE FUTURE ROLE OF NON-DESTRUCTIVE TESTING,
Central Metallurgical Labs., Whetstone (England).
J. A. Derry.
Engl Elec J, Vol 23, No 3 and 4, pp 28-34 and 28-31, May-June/July-Aug, 1968. 11 p, 14 fig, 14 ref.

Descriptors: *Non-destructive tests, Inspection, Instrumentation, Measuring instruments, *Quality control, Materials control, *Materials testing, Test procedures, *Radiographic inspection, Microwaves, Infrared radiation, Thermographs, Ultrasonics.
Identifiers: Great Britain, Infrared detectors, Thermometric method, Ultrasonic imaging, *Ultrasonic tests, Radiography.

Radiography, microwave, thermography, and ultrasonic techniques for non-destructive testing are discussed. Recent developments are described and possible applications suggested. New radiographic techniques include: (1) color radiography for complex components, (2) neutron radiography for heavy materials normally beyond the range of conventional methods, (3) high-speed or flash radiography for ballistic studies, and (4) cine radiography for investigations in foundry technology. Microwaves have application with nonmetallic materials and are used to examine flaws and inclusions in composite materials, and to determine thickness, density, voids, and the state of cure in plastics. The introduction of infrared detectors or radiometers permits thermographic mapping of a component's surface for detecting defects, and appears most promising for examining bonds, spot welds, honeycomb structures, and perhaps printed circuits. In ultrasonics, new developments include recording systems, the ultrasonic camera, and modulated apparatus, leading to automated systems for high production rate inspection of sheet and bar stock forgings. (USBR)
W69-03787

8I. Fisheries Engineering

FISHWAYS AND DAMS.

Me Rev Stat Ann tit 12, secs 2202, 2203, 2205 (1965); Me Rev Stat Ann tit 12, secs 2201, 2204 (1968-69 Supp).

Descriptors: *Legislation, *Maine, *Fish passages, *Dams, Engineering structures, Fish hatcheries, Fish handling facilities, Fish migration, Fish management, Fish barriers, Streams, Rivers, Dam construction, Administrative agencies, Riparian land, Banks.
Identifiers: *Fishways, Brooks, Commissions.

This chapter deals with fishways and dams. It provides that any person who tampers, damages, or pollutes a fishway shall be subject to a fine not to exceed $100. In addition, no person shall build a dam or other obstruction in rivers, streams, or brooks without first filing written notice with the Commissioner. Whenever the Commissioner deems it expedient, he may require a fishway to be erected, repaired, or altered by dam owners. The Commissioner must hold a hearing after due notice to the owners. A civil action lies against any owner who refuses to comply with the Commissioner's order. Furthermore, the statute provides that anyone who tampers with any dam owned or operated by the department, including dams in a fish hatchery, shall be punished by a fine of not more than $100. Finally, the statute makes it a misdemeanor for anyone to bulldoze between the banks of a river or stream without obtaining permission from the Commissioner. (Stewart-Fla)
W69-04164

09. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, AND Research Act Allotments

A HISTORY OF FEDERAL INVOLVEMENT IN THE MARINE SCIENCES: EMERGENCE OF THE NATIONAL SEA GRANT PROGRAM,
National Science Foundation, Washington, D. C.
Robert B. Abel.
Nat Resources Lawyer, Vol 1, No 3, pp 105-114, July 1968, 10 p.

Descriptors: *Legislation, *Federal government, *Grants, *Oceanography, Research facilities, Education, Colleges, Hydrography, Mapping, Exploration, Exploitation, Project purposes, Geological surveys, Allotments, Scientific personnel, Training, Legal aspects, Project planning, Marine geology.

Prior to 1960, there was little organized oceanographic research in the United States. The three federal agencies carrying on the majority of this work were the U. S. Navy, the U. S. Coast and Geodetic Survey, and the Bureau of Commercial Fisheries. Since 1960, however, congress has become increasingly involved in establishing a strong national program in the marine sciences. Congress has passed fisheries research programs, has expanded the functions and geographical limits of the Coast Guard (and of the Geodetic Survey) and has held extensive hearings and investigations on oceanographic research and technology. These have culminated in the National Sea Grant College and Program Act of 1966. Reasons, such as increased involvement on the part of scientists in governmental administrative capacity, are given to explain the congressional interest. The purpose of the National Sea Grant Act is to create a comprehensive program for assisting private and state institutions in their programs for ocean exploration and exploitation. The author encourages that most of the funds made available by the Act be utilized for support of established programs which show evidence of merit, with limited funding of new projects in undeveloped areas. (Kelly-Fla)
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